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Algae of the  
Susquehanna River Basin  
In New York George J. Schumacher

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# Algae of the Susquehanna River Basin In New York<sup>1</sup>

By George J. Schumacher <sup>2,3</sup>

## INTRODUCTION

The algae of the Susquehanna River Basin in New York are not well known. The earliest work of any consequence was a biological survey of the watershed, conducted by the New York State Conservation Department in 1935. This was restricted to lakes, however, and identifications were made only to genera. Since that time, only the work of Hohn (1951) is significant. This investigation was concerned with the diatom distribution in western New York and included 57 taxa from the Susquehanna basin. More recently, two unpublished theses have dealt with this area. Patricia Lane (1966) studied the plankton algae of two small ponds near Binghamton, while Wager (1968) investigated the seasonal variations in the net phyto-plankton of the Susquehanna in the vicinity of Binghamton.

Other rivers and river basins in this State have been studied in somewhat the same manner as described in this report; e.g., Schumacher (1961), but the present effort is more complete and comprehensive than any of the others, particularly in respect to the desmids and other planktonic forms. A general review of limnological investigations in New York and the other Middle Atlantic States can be found in Berg (1963).

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<sup>1</sup> A survey sponsored by the New York State Museum and Science Service.

<sup>2</sup> Professor of Biology, State University of New York at Binghamton, Binghamton, New York; under temporary appointment as Senior Scientist (Botany) in the New York State Museum and Science Service Biological Survey for this project.

<sup>3</sup> Manuscript submitted for publication March 18, 1969

The Susquehanna River drains 6,080 square miles of New York State (Hoyt and Anderson, 1905); this equals 13 percent of the entire State (Fig. 1). It drains all or sizeable parts of the following counties: Broome, Chemung, Chenango, Cortland, Delaware, Madison, Otsego, Schuyler, Steuben, Tioga, and Tompkins. It has its origin in Otsego Lake, near Cooperstown, in Otsego County and flows southwesterly until it reaches Broome County. Here it dips to the south and enters Susquehanna County, Pennsylvania. It quickly returns to New York and continues west until it reaches the southwest corner of Tioga County where it turns south and again enters Pennsylvania. It continues through Pennsylvania in a southeasterly direction, crossing Maryland and finally emptying into Chesapeake Bay.

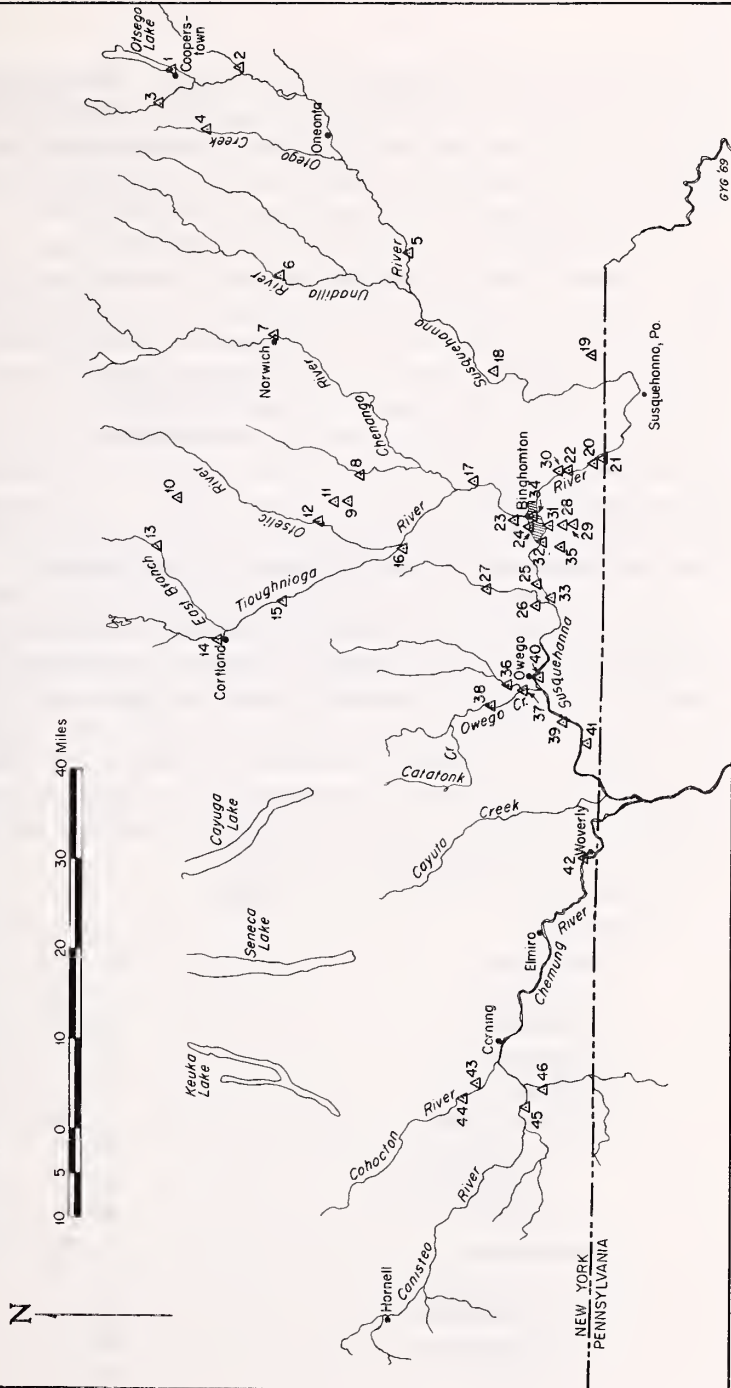
The Susquehanna basin in New York is part of the Allegheny Plateau and consists generally of rolling, somewhat broken country. The plateau separates those waters flowing north and west into the St. Lawrence, Great Lakes, or the Mississippi from those draining south and east into the Atlantic. According to the New York State Department of Health (1954) "the main use of the land is for farming and raising cattle; second-growth timber covers the ridges and slopes; residential areas, industrial areas and the major portions of recreation areas are located primarily in unincorporated communities."

The primary objective of this study has been to collect and identify the desmids of the Susquehanna River Basin in New York. The desmids are green algae assigned to the families Mesotaeniaceae and Desmidiaceae. In general, waters that are shallow, rich in organic acids, and with a pH of 5.0 to 6.8 are ideal habitats. Permanent pools, shallow ponds, edges of bogs, and lakes with little or no current present excellent conditions for desmid populations. Several terms can properly be used in describing the precise location of a desmid habitat and they appear throughout the annotated list. They are as follows: euplankton (true floating or drifting), periphyton (attached to aquatic plants near the surface), and tycho-plankton (entangled with various plants near the shore in shallow water).

One common method of sampling the euplankton is to pull or tow an extremely fine plankton net through the open water and place the material trapped in the net into a vial. The words "tow" or "straining" are often used to designate this type of sampling. In this survey, tows and strainings yielded many diatoms as well



Fig. 1 Susquehanna River Drainage  
in New York State  
SHOWING COLLECTING STATIONS



as desmids and other planktonic green algae. To collect tycho-plankton samples, the various aquatic plants are usually gently pulled from the water and the entangled algae flushed into the collecting container by squeezing the plants over a jar. This type of collection is commonly known as a "squeezing."

Most collections were made in situations favoring a desmid flora; however, sampling was not restricted to these particular locations. Wherever the conditions warranted, other samples were taken at these stations and it was not uncommon to collect algae attached to rocks, twigs, and dams, or those forming mats on the muddy bottom as well as algae from other ecological niches. This accounts for many of the blue-green and filamentous green algae recorded in this study. However, certain aquatic habitats that ordinarily do not support desmid growth were not visited. This explains the absence of certain major groups of algae in this report, notably the reds (Rhodophyta) and the stoneworts (Charophyceae).

All taxa identified during this survey have been arranged in an annotated list. Following each name is a word or phrase describing the particular type of sample in which it was found. This is usually followed by the sampling station and the county in which that station is located. In many instances, information such as relative abundance and seasonal distribution is given if it is considered important. In addition, some taxonomic characteristics are frequently included when they can be readily seen or measured and can be useful in the identification of that taxon.

A summary of the taxa is as follows:

Chlorophyta .....	258
Volvocales .....	4
Tetrasporales .....	9
Ulotrichales .....	21
Oedogoniales .....	3
Cladophorales .....	5
Chlorococcales .....	81
Pediastrum .....	17
Scenedesmus .....	21
Others .....	43
Zygnematales .....	135
Closterium .....	21
Cosmarium .....	33
Staurostrum .....	30
Other .....	51

Euglenophyta .....	7
Chrysophyta .....	78
Xanthophyceae .....	3
Chrysophyceae .....	10
Bacillariophyceae .....	65
Centrales .....	4
Pennales .....	61
Pyrrophyta .....	4
Cyanophyta .....	56
Chroococcales .....	21
Chamaesiphonales .....	1
Oscillatoriales .....	34
	<hr/>
	Total      403

The desmids represent the largest single group of algae with 132 taxa within the order Zygnematales. The desmids are all illustrated. The second largest group is the diatoms with 65 representatives within the Bacillariophyceae.

All illustrations were made directly from living material with the aid of the camera lucida or from photographs of the living material.

## COLLECTING STATIONS<sup>4</sup>

OTSEGO CO. 1. Otsego Lake, Cooperstown. The Susquehanna River heads in Otsego Lake at an altitude of 1193 feet. The lake is approximately 7.5 miles long by 1.5 miles wide. Most collections were taken at the south end of the lake near the beginning of the Susquehanna River.

2. Cherry Valley Creek, 5 miles east of Milford. Altitude approximately 1167 feet. The origin of this creek is in the vicinity of Cherry Valley. The creek flows in a southwest direction, reaching the Susquehanna at Milford, 8 miles south of Otselic Lake.

3. Oak Creek, Oaksville. A small stream flowing southeast from Schuyler Lake and joining the Susquehanna 3 miles south of Otsego Lake.

4. Otego Creek, Hartwick. Otego Creek has its beginnings a few miles west of Oaksville and flowing southward joins the Susquehanna 3 miles west of Oneonta.

5. Susquehanna River, Unadilla. This station is 40 miles from the source and the elevation is 1000 feet — a drop of 167 feet.

CHENANGO CO. 6. Unadilla River, South New Berlin. The river's origin is in the town of Bridgewater. It flows southward until it joins with the Susquehanna near Sidney.

7. Chenango River, Norwich. Rising in Madison County, the Chenango River flows south and west, joining the Susquehanna at Binghamton.

8. Genegantslet Creek, Smithville Flats. Originating near East Pharsalia, Genegantslet Creek flows south through Chenango County until it meets the Chenango River 3 miles south of Greene.

9. Cincinnatus Lake. A large lake used commercially for swimming and fishing, situated on the border of Cortland and Chenango Counties. Samples were taken at the southeastern end, near the outlet.

10. Mud Creek, Linklaen. Mud Creek has its origin in the northwest corner of Chenango County. After flowing south it joins the Otselic River near Pitcher.

CORTLAND CO. 11. Stump Lake, just north of Cincinnatus Lake on N.Y. Route 41. A shallow lake with a rich muck bottom and numerous submerged stumps.

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<sup>4</sup> See Fig. 1.

12. Otselic River, Willet. This is the main tributary of the Tioughnioga River. It rises in Madison County, joining the Tioughnioga at Whitney Point to the southwest.

13. East Branch of the Tioughnioga, 2 miles south of Cuyler. The East Branch flows southwest from its origin in Madison County to the town of Cortland where it unites with the West Branch.

14. West Branch of the Tioughnioga, southern city limits of Homer. Beginning near Tully, the West Branch joins the East Branch at Cortland.

15. Tioughnioga River, 4.5 miles north of Marathon. The Tioughnioga is the main tributary of the Chenango and joins it at Chenango Forks.

BROOME CO. 16. Junction of Tioughnioga and Otselic Rivers, Whitney Point. The Tioughnioga continues from Whitney Point south and east to meet the Chenango.

17. Lily Lake, Chenango State Park, 9 miles north of Binghamton.

18. Pickerel Pond, 1.5 miles southeast of Nineveh. Altitude approximately 1527 feet. The presence of submerged aquatic plants and warm, shallow, slightly acidic water make this pond ecologically ideal for desmids.

19. Camp Tuscarora, Gulf Summit. A lake located in a Boy Scout camp near the Pennsylvania border.

20. Big Snake Creek, Corbettsville. The Big Snake actually has its beginning in Pennsylvania, but it flows northward and into the Susquehanna River at Corbettsville.

21. Big Snake Creek, .75 miles southwest of Corbettsville, just north of Pennsylvania border.

22. Little Snake Creek, Conklin Corners.

23. Boland Pond, on Thomas Brook. A beaver pond north of Chenango River bridge, Route 11, north side of Binghamton.

24. Little Choconut Creek, Stella Ireland Road, Binghamton.

25. Small swamp between Erie-Lackawanna railroad and Watson Boulevard, west of I.B.M. Golf Course, Endicott.

26. Small stream, 1 mile north of Glendale Road and Route 11 junction.

27. Nanticoke Creek, Maine. This creek flows from the northern section of the county southward and empties into the Susquehanna at Endicott.

28. Pond 1, Hawleytown Road, 2 miles south of Binghamton, See No. 29.

29. Pond 2, Hawleytown Road, 2 miles south of Binghamton. This pond and the one listed in No. 28 are two very small private ponds along the Hawleytown Road. Both are shallow with clay bottoms.

30. Susquehanna River, bridge between Conklin and Binghamton.

31. Susquehanna River, below the confluence with the Chenango.

32. Susquehanna River, .5 miles below Binghamton-Johnson City sewage treatment plant.

33. Susquehanna River, Route 26 bridge, Endicott.

34. Chenango River, Main Street bridge, Binghamton, .5 miles upstream from its junction with the Susquehanna.

35. Harpur Pond, S.U.N.Y. campus, Binghamton. Shallow, soft-bottomed pond at south end of campus. Fed by runoff from surrounding hills; water circum-neutral.

TIOGA CO. 36. Owego Creek, 1.6 miles north of junction of Routes 38 and 96.

37. Owego Creek, at junction of Routes 38 and 96.

38. Owego Creek, 1.6 miles north of Catatonk.

39. Pipe Creek, Tioga Center. A small creek emptying into the Susquehanna River at Tioga Center.

40. Susquehanna River, Route 96 bridge, Owego.

41. Susquehanna River, Smithboro.

CHEMUNG CO. 42. Chemung River, 2 miles west of Waverly. The Chemung River is formed by the union of the Canisteo, Cohocton, and Tioga Rivers near Painted Post. From there it flows southeast, enters Pennsylvania, and joins with the Susquehanna near Athens.

STEUBEN CO. 43. Meade Creek, 2.5 miles west of Painted Post on U.S. Route 15. Arising in Schuyler County, Meade Creek follows a course southwest and meets the Cohocton River near Cooper's Plains.

44. Cohocton River, Curtis. Originating in Livingston County, the Cohocton flows southeast and joins the Canisteo River at Painted Post forming the Chemung River.

45. Canisteo River, 2.5 miles east of Addison. The headwaters of the Canisteo are in Allegany County. The river joins with the Cohocton to form the Chemung.

46. Tioga River, Prescho. The Tioga flows north from Pennsylvania into New York and merges with the Canisteo near Erwins.



## ANNOTATED LIST

DIVISION — *CHLOROPHYTA*

CLASS — *CHLOROPHYCEAE*

ORDER — *VOLVOCALES*

FAMILY — *VOLVOACEAE*

*Gonium pectorale* Mueller. In plankton and squeezings of aquatic plants, summer. Tioughnioga River, Little Snake Creek, and Pickerel Pond, Broome Co.; Otselic River, Cortland Co.

*Pandorina morum* (Muell.) Bory. Rare or infrequent in plankton and plant squeezings but rather widespread in creeks, rivers, and ponds of Broome, Chemung, Chenango, Cortland, and Otsego Cos.

*Eudorina elegans* Ehren. Apparently widespread throughout the Susquehanna and its tributaries, becoming abundant in plankton of warm summer months.

*Volvox tertius* Meyen. In plankton of Pond 1, Hawleytown Road, Broome Co., particularly common in winter months. Should be present in waters of other ponds in area.

### TETRASPORALES

#### PALMELLACEAE

*Sphaerocystis Schroeteri* Chodat. In tows and squeezings of aquatics of Pickerel Pond and Susquehanna River, Broome Co.; Chemung River, Chemung Co.; Stump Lake and West Branch Tioughnioga River, Cortland Co.

*Gloeocystis ampla* (Kuetz.) Lager. In tows and squeezings. Pickerel Pond and Susquehanna River, Broome Co.; Genegantslet Creek, Chenango Co.; West Branch Tioughnioga River, Cortland Co.

*G. gigas* (Kuetz.) Lager. Infrequent in plankton of Tioughnioga River, Broome Co.; Cincinnatus Lake and Genegantslet Creek, Chenango Co.; Otselic River and Stump Lake, Cortland Co.

*Asterococcus limneticus* G. M. Smith. Rare in strainings from Pickerel Pond and Big Snake Creek, Broome Co.

#### TETRASPORACEAE

*Tetraspora gelatinosa* (Vauch.) Desv. Entangled near shore about *Sparganium* stems. Owego Creek, Tioga Co.

*T. lubrica* (Roth) C. A. Agardh. Along shoreline of Harpur Pond, Broome Co. Frequent in fall months when water temperature is near freezing and pH is about 6.6.

*Schizochlamys gelatinosa* A. Braun. Frequent to abundant in quiet water along margins of Harpur Pond, Broome Co. Similar location to *Tetraspora lubrica*. Fig. 140.

### CHLORANGIACEAE

*Stylosphaeridium stipitatum* (Bachm.) Geitler & Gimesi. A frequent epiphyte on colonies of *Coelosphaerium Naegelianum*, a blue-green alga, during summer plankton of Susquehanna River, Broome Co. Fig. 137.

### COCCOMYXACEAE

*Elakatothrix gelatinosa* Wille. Occasional colonies seen in spring plankton of Pond 1, Hawleytown Road, Broome Co.

### ULOTRICHALES

#### ULOTRICHACEAE

*Ulothrix* sp. Rather widespread along shores and in plankton of streams in area.

*U. zonata* (Weber & Mohr) Kuetz. Frequent in spring plankton of Susquehanna River, Broome Co.; on submerged rocks in Tioughnioga River, Cortland Co.

*Stichococcus subtilis* (Kuetz.) Klercker. In squeezings of plants from Genegantslet Creek, Chenango Co.

*Geminella interrupta* (Turp.) Lager. Filaments found in floating debris of Lily Lake, Broome Co.; Otsego Lake, Otsego Co.

*Radiofilum conjunctivum* Schmidle. Entangled among *Sparganium* stems, Stump Lake, Broome Co.

*R. flavescens* G. S. West. Several filaments collected in debris along shore during September, Little Choconut Creek, Broome Co. Fig. 143.

### MICROSPORACEAE

*Microspora crassior* (Hansg.) Hazen. This thick-walled species was infrequent and scattered in September with debris along shore of Little Choconut Creek, Broome Co.



*M. stagnorum* (Kuetz.) Lager. In plankton of Tioughnioga River and Harpur Pond, Broome Co.

*M. tumidula* Hazen. Frequent in summer tychoplankton of Stump Lake, Broome Co.

### CYLINDROCAPSACEAE

*Cylindrocapsa conferta* W. West. Rare to infrequent in spring plankton of Chenango and Susquehanna Rivers, Broome Co. Probably washed in from nearby ponds or bogs.

### CHAETOPHORACEAE

*Stigeoclonium* sp. Scattered fragments on rocks of Tioughnioga River, Marathon, Cortland Co.

*Chaetophora incrassata* (Huds.) Hazen. Forming green gelatinous strands in summer on pebbles near shore of Otsego Lake, Otsego Co.

*Draparnaldia acuta* (C. A. Agardh) Kuetz. Attached to *Sparganium* stems, common in Camp Tuscarora Lake, Broome Co.

*D. glomerata* (Vauch.) C. A. Agardh. Branched green filaments attached to rocks and twigs in 6-8 inches of water, Tioughnioga River, Whitney Point, Broome Co.

*D. plumosa* (Vauch.) C. A. Agardh. Frequent in spring in Harpur Pond, Broome Co.

*Aphanochaete repens* A. Braun. Epiphytic upon filaments of *Cladophora* and *Oedogonium* in Pickerel Pond, Broome Co.; Cincinnatus Lake and Otselic River, Cortland Co. Fig. 139.

### PROTOCOCCACEAE

*Protococcus viridis* C. A. Agardh. Widespread throughout entire study area wherever suitable surfaces are found.

### COLEOCHAETACEAE

*Coleochaete orbicularis* Pringsheim. Found in squeezings of *Anacharis* from West Branch of Tioughnioga River, Cortland Co.

*C. pulvinata* A. Braun. From scrapings of submerged stump, Stump Lake, Cortland Co.

*Chaetosphaeridium Pringsheimii* Klebahn. Frequent on stems of *Pontederia* throughout Pickerel Pond, Broome Co. Fig. 134.

### TRENTOPOHLIACEAE

*Gongrosira lacustris* Brand. Frequent in scrapings of rocks and bridge foundations, Owego Creek, Tioga Co.

### OEDOGONIALES

#### OEDOGONIACEAE

*Oedogonium* sp. Found in most habitats throughout study area. *O. Reinschii* Roy. Because of the hexagonal shaped vegetative cells, this is one of the few species of *Oedogonium* that can be identified without fruiting material. Along border and mixed with *Sphagnum* of Pickerel Pond, Broome Co.

*Bulbochaete* sp. Not as widespread as *Oedogonium*. Restricted to Pickerel Pond, Broome Co.; Cincinnatus Lake, Chenango Co.; Stump Lake, Cortland Co.

### CLADOPHORALES

#### CLADOPHORACEAE

*Cladophora crispata* (Roth) Kuetz. Floating filaments in the West Branch of Tioughnioga River, Cortland Co.

*C. glomerata* (L.) Kuetz. Attached to rocks and sticks, often with the epiphyte *Aphanocapsa repens*. Chenango and Tioughnioga Rivers, Broome Co.; Cherry Valley Creek, Otsego Co.; Meade Creek and Canisteo River, Steuben Co.

*Rhizoclonium hieroglyphicum* (C. A. Agardh) Kuetz. Thicker walls than typical, up to  $7\mu$  in some. Common floating green, August, Tioga River, Steuben Co.

*Basycladia Chelonum* (Collins) Hoffman & Tilden. Long green filaments collected from shells of several species of turtles, spring and summer, Broome Co.

*Pithophora Oedogonia* (Mont.) Wittr. In autumn collections from quiet waters around edge of Harpur Pond, Broome Co.

### CHLOROCOCCALES

#### CHLOROCOCCACEAE

*Chlorococcum humicola* (Naeg.) Raben. Cells solitary and in clusters, Stump Lake, Broome Co.

### MICRACTINIACEAE

*Micractinium pusillum* var. *elegans* G. M. Smith. Excellent colonies with each cell bearing many long setae, spring, Susquehanna River, Broome Co.

### DICTYOSPHAERIACEAE

*Dictyosphaerium Ehrenbergianum* Naegeli. Frequent in squeezings of aquatics from Pickerel Pond and Camp Tuscarora Lake, September, Broome Co.

*D. pulchellum* Wood. More common than previous species. Tioughnioga River and Pickerel Pond, Broome Co.; Stump Lake, Cortland Co.; quite common in summer plankton of Susquehanna River, Broome Co.

*Dimorphococcus lunatus* A. Braun. Autumn and winter plankton of Harpur Pond, Broome Co.

### CHARACIACEAE

*Characium ambiguum* Hermann. Epiphytic on *Cladophora* during summer collections. Chenango River, Broome Co.; Canisteo River, Steuben Co. Fig. 129.

*C. ensiforme* Hermann. As above, epiphytic on *Cladophora*, Chenango River, Broome Co. Fig. 130.

*C. limneticum* Lemmermann. With blue-greens on submerged log, Genegantslet Creek, Chenango Co. Fig. 131.

### HYDRODICTYACEAE

*Pediastrum araneosum* var. *rugulosum* (G. S. West) G. M. Smith. Easily recognized because of the undulate cell walls. Only seen in tychoplankton of Camp Tuscarora Lake, Broome Co.

*P. biradiatum* G. M. Smith. In summer plankton, Susquehanna River, Broome Co.

*P. biradiatum* var. *heteracanthum* G. M. Smith. A rare variety, identified by the unequal incisions in the apices of the marginal cells, and the interstices of the interior cells. Summer plankton in Susquehanna River, Broome Co. Fig. 149.

*P. Boryanum* (Turp.) Meneghini. One of the most widespread and common planktonic green algae. Found in every collecting station, often frequent to common in summer and autumn.

- P. Boryanum* var. *longicorne* Raciborski. Rather rare in spring and summer collections from Chenango and Susquehanna Rivers, Broome Co.
- P. Boryanum* var. *undulatum* Wille. In plankton and floating debris of Tioughnioga River, Broome Co.; Tioga River, Steuben Co.; Owego Creek, Tioga Co.
- P. duplex* Meyen. Frequent planktonic form in Susquehanna River, Broome Co.
- P. duplex* var. *clathratum* (A. Braun) Lager. In squeezings of *A. acharis* from Owego Creek, Tioga Co.
- P. duplex* var. *coharens* Bohlin. Almost as widespread as *P. Boryanum*. Certainly a widely distributed taxon throughout the area.
- P. duplex* var. *gracillimum* West & West. Often reaching high numbers during summer plankton in Chenango and Susquehanna Rivers, Broome Co.
- P. duplex* var. *reticulatum* Lager. Infrequent in plankton samples of Chenango and Susquehanna Rivers, Broome Co.
- P. integrum* Naegeli. Occasionally seen in samples from Cohocton River, Steuben Co.; Owego Creek, Tioga Co. Fig. 150.
- P. obtusum* Lucks. Found only in squeezings of *Sphagnum* from border of Pickerel Pond, Broome Co.
- P. simplex* (Meyen) Lemmermann. Seen in September plankton collections from Susquehanna River, Broome Co.
- P. simplex* var. *duodenarium* (Bailey) Raben. Infrequent in July plankton samples. Several coenobia with cells bearing hyaline setae on terminal projections, Susquehanna River, Broome Co. Fig. 147.
- P. tetras* (Ehren.) Ralfs. Quite common throughout entire region.
- P. tetras* var. *tetraodon* (Corda) Hansgirg. This variety, with 8-celled coenobia and more pronounced and deeper incisions found in Geneganslet Creek, Chenango Co.
- Sorastrum americanum* var. *undulatum* G. M. Smith. A beautiful planktonic taxon with undulate walls along interior margins. Camp Tuscarora and Pickerel Pond, Broome Co.
- S. spinulosum* Naegeli. Scattered in area's plankton. Susquehanna River, Broome Co.; Cincinnatus Lake, Chenango Co.; Stump Lake and West Branch Tioughnioga River, Cortland Co.; Meade Creek and Cohocton River, Steuben Co.; Catatonk Creek, Tioga Co.
- Hydrodictyon reticulatum* (L.) Lagerheim. Common in all rivers and larger creeks in area. Often forming abundant, large, green

mats along margins during hot weather of late summer when water level is low. Mats turning orange as cells decay.

### COELASTRACEAE

*Coelastrum cambricum* Archer. In squeezings of aquatics from Camp Tuscarora Lake and Pickerel Pond, Broome Co.

*C. microporum* Naegeli. Widespread in squeezings and plankton samples from most stations.

*C. sphaericum* Naegeli. Quite rare, found only in Susquehanna River, Broome Co.

### BOTRYOCOCCACEAE

*Botryococcus Braunii* Kuetz. Entangled on aquatic stems, Pickerel Pond, Broome Co.; Cincinnatus Lake, Chenango Co.

*B. sudeticus* Lemmermann. Rare in plankton of West Branch of Tioughnioga River, Cortland Co.

### OOCYSTACEAE

*Treubaria setigerum* (Archer) G. M. Smith. Rare in Susquehanna River plankton, Broome Co.

*Oocystis Borgei* Snow. Observed in August collections from Susquehanna River, Broome Co.

*O. Naegelii* A. Braun. A single chromatophore distinguishes this from the previous species. Found only in plankton of Stump Lake, Cortland Co. Should be found elsewhere.

*O. parva* West & West. Also found in Stump Lake, Cortland Co., but cells have pointed ends, not rounded as in previous taxa.

*Nephrocytium Agardhianum* Naegeli. In squeezings from Stump Lake, Cortland Co.

*N. lunatum* W. West. Infrequent in plankton of Susquehanna River, Broome Co.

*Chodatella subsalsa* Lemmermann. Rare in Susquehanna River plankton, Broome Co.

*Ankistrodesmus falcatus* (Corda) Ralfs. Quite common and widely distributed in many situations.

*A. falcatus* var. *mirabilis* (West & West) G. S. West. The long solitary cells of this variety were seen only in Genegantslet Creek, Chenango Co.

*A. falcatus* var. *stipitatus* (Chod.) Lemmermann. This variety has been seen but records are not clear and exact location cannot be established. Fig. 132.

- Selenastrum Bibraianum* Reinsch. In tow of water from Genegantslet Creek, Chenango Co.
- S. Westii* G. M. Smith. Tioughnioga River, Broome Co.; Genegantslet Creek, Chenango Co.
- Kirchneriella contorta* (Schmidle) Bohlin. Plankton of Tioughnioga River, Broome Co.
- K. lunaris* (Kirch.) Moebius. Cells strongly curved. Little Snake Creek, Broome Co.
- K. lunaris* var. *irregularis* G. M. Smith. Lunate cells with the apices pointing in different directions are peculiar to this variety. Camp Tuscarora Lake and Little Snake Creek, Broome Co.; Oak Creek, Otsego Co.; Owego Creek, Tioga Co.
- K. obesa* (W. West) Schmidle. Plump cells with bluntly pointed ends, Camp Tuscarora Lake, Broome Co.
- Quadrigula closteroides* (Bohlin) Printz. In squeezings of *Sphagnum* stems, Camp Tuscarora Lake, Broome Co.
- Tetraedron enorme* (Ralfs) Hansgirg. Squeezings of *Sphagnum* along border of Pickerel Pond, Broome Co.
- T. minimum* (A. Braun) Hansgirg. Plankton of Tioughnioga River, Broome Co.; frequent in squeezings of Owego Creek, Tioga Co.
- T. pentaedricum* West & West. Squeezings of *Sphagnum* along border of Pickerel Pond, Broome Co.
- Cerasterias staurastroides* West & West. Like those reported by Prescott from the Great Lakes region, my cells have processes tipped with 3 short, sharp teeth. Cincinnatus Lake, Chenango Co.

### SCENEDESMACEAE

- Scenedesmus abundans* (Kirch.) Chodat. Plankton of Tioughnioga River, Broome Co.; tychoplankton of East Branch Tioughnioga, Cortland Co.; Oak Creek, Otsego Co.; common in scrapings of rocks and bridge foundations, Owego Creek, Tioga Co.
- S. abundans* var. *longicauda* G. M. Smith. Cells with spines up to  $10\mu$  long. In Susquehanna River, Broome Co.; Owego Creek, Tioga Co.
- S. acuminatus* var. *tetradesmoides* G. M. Smith. Cells of this alga are not all in one plane when coenobe is seen in apical view. Genegantslet Creek, Chenango Co.
- S. acutiformis* Schroeder. Genegantslet Creek, Chenango Co.; Stump Lake, Cortland Co.; Owego Creek, Tioga Co.; Tioga River, Steuben Co.



- S. arcuatus* Lemmermann. Cells arranged in curved arc like *S. acuminatus* var. *tetradesmoides* but its cells have rounded apices, not pointed, Tioughnioga River, Cortland Co.
- S. arcuatus* var. *platydisca* G. M. Smith. Generally distributed in lake and stream plankton.
- S. armatus* (Chod.) G. M. Smith. In squeezings from Tioughnioga River, Broome Co.; Cincinnatus Lake and Unadilla River, Chenango Co.; East Branch Tioughnioga, Cortland Co.; Oak Creek, Otsego Co.
- S. armatus* var. *Chodatii* G. M. Smith. In tows and squeezings from Tioughnioga River, Broome Co.; Cincinnatus Lake and Genegantslet Creek, Chenango Co.; West Branch Tioughnioga, Cortland Co.; Owego Creek, Tioga Co.
- S. bijuga* (Turp.) Lager. Common in squeezings of *Sphagnum* from Pickerel Pond, Broome Co. and common in scrapings of rocks in Owego Creek, Tioga Co.
- S. bijuga* var. *alternans* (Reinsch) Hansgirg. Tioughnioga and Susquehanna Rivers, Little Snake Creek, Broome Co.; Susquehanna River, Chenango Co.
- S. brasiliensis* Bohlin. Widespread throughout area. Collected in plankton, squeezings, in floating debris, on dams and with filaments of blue-greens from mud bottoms.
- S. denticulatus* Lager. In plankton of Tioughnioga River, Broome Co.; squeezings from Cincinnatus Lake, Chenango Co.; on mud bottom of West Branch Tioughnioga, Cortland Co.
- S. denticulatus* var. *linearis* Hansgirg. In squeezings from Genegantslet Creek, Chenango Co.
- S. dimorphus* (Turp.) Kuetz. Quite common in region and in varied habitats.
- S. hystrix* Lager. In squeezings of aquatics from West Branch of Tioughnioga River, Cortland Co.
- S. obliquus* (Turp.) Kuetz. In squeezings of plants and scrapings of rocks. Genegantslet Creek, Chenango Co.; Chemung River, Chemung Co.; Oak Creek, Otsego Co.; Owego Creek, Tioga Co.
- S. quadricauda* (Turp.) Bréb. In tows and squeezings from Susquehanna River, Broome Co.; Chemung River, Chemung Co.; Tioga River, Steuben Co.; Owego Creek, Tioga Co.
- S. quadricauda* var. *longispina* (Chod.) G. M. Smith. Tychoplankton of Boland Pond, Broome Co.; Genegantslet Creek, Chenango Co.

- S. quadricauda* var. *maximus* West & West. In plankton samples from Susquehanna River, Broome Co.
- S. quadricauda* var. *parvus* G. M. Smith. In plankton of Chenango River, Broome Co.; with blue-greens on mud, Genegantslet Creek, Chenango Co.
- S. serratus* (Corda) Bohlin. Squeezings from Genegantslet Creek, Chenango Co.
- Crucigenia apiculata* (Lemm.) Schmidle. A very short tooth found on the free apex of each cell. Owego Creek, Tioga Co.
- C. quadrata* Morren. Squeezings of *Anacharis* from West Branch of Tioughnioga River, Cortland Co.
- C. rectangularis* (A. Braun) Gay. In plankton of Harpur Pond, Broome Co.; squeezings from Genegantslet Creek, Chenango Co.
- Actinastrum gracillimum* G. M. Smith. Summer plankton of Susquehanna River, Broome Co.
- A. Hantzschii* Lager. Frequent in summer plankton of Susquehanna River, Broome Co.
- A. Hantzschii* var. *fluviatile* Schroeder. Occasionally seen in plankton of Susquehanna River, Broome Co.

## ZYGNEMATALES

### ZYGNEMATACEAE

- Mougeotia* sp. Sterile material collected in Big and Little Snake Creeks, Pickerel Pond, Broome Co.; Genegantslet Creek, Chenango Co.
- Zygnema* sp. Only vegetative filaments seen in samples from Pickerel Pond and Camp Tuscarora Lake, Broome Co.; Stump Lake, Cortland Co.; Otsego Lake, Otsego Co.
- Spirogyra* sp. Truly cosmopolitan throughout the area. Non-fruiting material only.

### MESOTAENIACEAE

- Gonatozygon aculeatum* Hastings. Found only in squeezings of *Pontederia* stems and with blue-greens on mud near shore of Pickerel Pond, Broome Co. Fig. 7.
- G. pilosum* Wolle. Squeezings of *Sphagnum* from Pickerel Pond, Broome Co.; squeezings of *Anacharis* and *Sparganium* stems, Stump Lake, Cortland Co. Fig. 8.



*Netrium digitus* (Ehren.) Itz. and Rothe. In squeezings and strainings from Little Choconut Creek, Pickerel Pond, and Camp Tuscarora Lake, Broome Co. Fig. 1.

*Spirotaenia condensata* Bréb. Rare in *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 14.

*S. obscura* Ralfs. A rather rare species, seen only in plankton of Harpur Pond, Broome Co. Fig. 13.

### DESMIDIACEAE

*Closterium acutum* (Lyngb.) Bréb. Smooth cells, gradually attenuated towards apices; pyrenoids several in a median series. Squeezings, Pickerel Pond, Broome Co. Fig. 25.

*C. costatum* Corda. Median girdle apparent, wall with seven to eight heavy striae. *Sphagnum* squeezings and with blue-greens on mud, Pickerel Pond, Broome Co. Fig. 10.

*C. Dianae* Ehren. Cell wall smooth and reddish in color, tips slightly truncate. Squeezings from Pickerel Pond, Broome Co.; Cincinnatus Lake, Chenango Co.; Owego Creek, Tioga Co. Fig. 4.

*C. didymotocum* Corda. Easily recognized in our material by the red-brown ring near each tip of the cell. With blue-greens on mud, Pickerel Pond, Broome Co. Fig. 27.

*C. Ehrenbergii* Menegh. Extremely large cells, some over  $700\mu$  in length; smooth walls; many scattered pyrenoids. Squeezings, Harpur Pond, Broome Co.; Genegantslet Creek, Chenango Co.; Owego Creek, Tioga Co. Fig. 9.

*C. gracile* Bréb. Smooth, colorless cells, very narrow (seldom over  $5\mu$  wide). Squeezings from Pickerel Pond, common in Boland Pond, Broome Co. Fig. 6.

*C. incurvum* Bréb. Lunate cells with smooth colorless walls and median pyrenoids. Squeezings from Camp Tuscarora Lake, frequent in Pickerel Pond, Broome Co.; Cincinnatus Lake and Genegantslet Creek, Chenango Co. Fig. 6a.

*C. intermedium* Ralfs. Walls golden-brown with 8 to 10 striations; truncate ends. Tycho plankton, Harpur Pond, Broome Co.; Stump Lake, Cortland Co. Fig. 20.

*C. juncidium* Ralfs. Pyrenoids median, striations evident, cells  $235\mu$ - $340\mu$  long. Plankton, Pickerel Pond and Chenango River, Broome Co. Fig. 19.

- C. Kuetzingii* Bréb. Cells with tumid centers; walls with very fine striations. Squeezings from Genegantslet Creek, Chenango Co. Fig. 24.
- C. Leibleinii* Kuetz. Smooth and colorless, resembling *C. Dianae* but differing in its tumid middle. Wide distribution in following counties: Broome, Chenango, Otsego, Steuben, and Tioga. Fig. 2.
- C. moniliferum* (Bory) Ehren. Similar to *C. Ehrenbergii* except for its pyrenoids arranged in a line. Often frequent to abundant in squeezings, Susquehanna River, Broome Co.; Genegantslet Creek, Chenango Co.; West Branch Tioughnioga, Cortland Co.; Owego Creek, Tioga Co. Fig. 5.
- C. Ralfsii* Bréb. Frequent in Harpur Pond and Susquehanna River, Broome Co. Fig. 12.
- C. Ralfsii* var. *hybridum* Raben. Large cells, some over  $500\mu$  long, with 15 or more striations. Squeezings and plankton from Pickerel Pond and Susquehanna River, Broome Co. Fig. 11.
- C. Ralfsii* var. *immane* Cushman. Larger than preceding, some over  $600\mu$  long, and with 50-60 striations. Squeezings of stems, Stump Lake, Cortland Co. Fig. 21.
- C. rostratum* Ehren. In winter plankton of Harpur Pond, Broome Co. Fig. 22.
- C. setaceum* Ehren. Swollen median section quickly narrowing to long attenuated apices; tips narrow, up to  $2.5\mu$  in width. *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 23.
- C. striolatum* Ehren. Robust cells with many striations and median pyrenoids. Plankton of Susquehanna River, Broome Co. Fig. 18.
- C. toxon* W. West. Long narrow cells, specimens average  $320\mu$  in length and  $9\mu$  wide. Plankton of Susquehanna River, Broome Co. Fig. 26.
- C. turgidum* Ehren. Light brown cells with many fine striations; apices recurved slightly. Huge cells possibly reaching  $800\mu \times 75\mu$ ; chloroplast ridged. Squeezings, plankton tows, and with blue-greens on mud bottom of Pickerel Pond, Broome Co.; West Branch of the Tioughnioga River, Cortland Co. Fig. 17.
- C. Venus* Kuetz. A delicate, lunate cell with only one or two pyrenoids per semicell. Plankton, Chenango River, Broome Co.; Stump Lake, Cortland Co. Fig. 3.
- Penium margaritaceum* (Ehren.) Bréb. Cells with girdles; granules many, in lines or scattered; older cells often colored. Broome, Cortland, and Otsego Cos. Fig. 16.

- P. spinospermum* Josh. A rare species in *Sphagnum* squeezings from Pickerel Pond, Broome Co. Fig. 16a.
- Pleurotaenium coronatum* (Bréb.) Raben. Walls punctate; poles with 10-12 tubercles. Plankton of Harpur Pond, Broome Co.; squeezings of Genegantslet Creek, Chenango Co. Fig. 30.
- P. Ehrenbergii* (Bréb.) DeBary. Entangled among aquatics, Pickerel Pond, Broome Co.; Stump Lake, Cortland Co. Fig. 28.
- P. nodosum* (Bailey) Lundell. Series of radially arranged swellings make this a distinctive taxon. *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 33.
- P. nodulosum* Bréb. Undulations run entire length of cell wall. Camp Tuscarora Lake, Broome Co. Fig. 36.
- P. subcoronulatum* var. *detum* West & West. Slight constriction near apex of each semicell can be seen on each specimen. Squeezings, occasionally frequent, Pickerel Pond, Broome Co.; Chemung River, Chemung Co. Fig. 29.
- P. trabecula* (Ehren.) Naegeli. Cells with several basal swellings and no apical tubercles. Widespread in Broome, Chenango, Cortland, Otsego, and Steuben Cos. Fig. 34.
- P. trabecula* var. *rectum* (Delp.) W. West. Smaller than the above and only a single basal undulation in each semicell. Squeezings, Pickerel Pond, Broome Co. Fig. 35.
- Tetmemorus Brebissonii* (Menegh.) Ralfs. Easily recognized by the apical notches. In *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 15.
- Euastrum abruptum* Nordstedt. Camp Tuscarora Lake, Broome Co. Fig. 39.
- E. abruptum* forma *minus* West & West. Terminal lobe with two small spines; cell wall with many granules. Squeezings from Pickerel Pond, Broome Co.; Genegantslet Creek, Chenango Co. Fig. 31.
- E. binale* forma *hians* West. A minute desmid, the largest reaching only  $20\mu$  in length. *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 32.
- E. evolutum* West & West. Tycho plankton, Pickerel Pond, Broome Co. Fig. 37.
- E. gemmatum* Bréb. Tycho plankton, Pickerel Pond, Broome Co. Fig. 40.
- E. obesum* var. *crassum* Prescott & Scott. A large *Euastrum*, averaging  $100\mu$  in length, with punctate walls. *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 41.

- E. verrucosum* var. *alatum* Wolle. Another large taxon. Squeezings from Cherry Valley Creek, Otsego Co. Fig. 38.
- Cosmarium amoenum* Bréb. Semicells with eight to 10 linear rows of granules on each face. In *Sphagnum* border of Pickerel Pond, Broome Co. Fig. 64.
- C. bipunctatum* Borg. Cells with truncate apices; walls granular with two prominent central granules. Squeezings from Pickerel Pond, Broome Co. Fig. 42.
- C. Botrytis* var. *subtumidum* Wittr. Striking ornamentation as the granulations become larger toward the center and apices. Squeezings from Stump Lake, Cortland Co. Fig. 43.
- C. contractum* var. *ellipsoideum* West & West. *Sphagnum* squeezings from Pickerel Pond, Broome Co. Fig. 73.
- C. cucumis* (Corda) Ralfs. Chromatophore in vertical parietal bands with numerous, scattered pyrenoids. Squeezings of *Pontederia* stems, Pickerel Pond, Broome Co. Fig. 44.
- C. curcubita* Bréb. Small cells with punctate walls. In *Sphagnum* border of Pickerel Pond, Broome Co. Fig. 54.
- C. denticulatum* forma *Borgei* Irénée-Marie. Very large, beautiful *Cosmarium* reaching almost  $200\mu$  in length. Approximately three rows of small spines or granules around lateral margins. Tycho-plankton, Pickerel Pond, Broome Co. Fig. 59.
- C. granatum* Bréb. Walls finely punctate; apex truncate; pyrenoid single. Scattered throughout area. Fig. 49.
- C. Hammeri* var. *protuberans* West & West. Rare, collected only on squeezings from Otsego Lake, Otsego Co. Fig. 48.
- C. impressulum* Elefv. Small cells with eight even undulations along margin. Tycho-plankton, Genegantslet Creek, Chenango Co.; Stump Lake, Cortland Co. Fig. 52.
- C. margaritatum* (Lund.) Roy & Biss. Walls with prominent granules, each granule surrounded by six small punctations. Squeezings from Camp Tuscarora Lake, Broome Co.; Stump Lake, Cortland Co. Fig. 57.
- C. margaritatum* forma *minor* West & West. Same as species, except smaller, reaching up to  $60\mu$  in length. Plankton, Lily Lake, and Susquehanna River, Broome Co. See species. Fig. 57.
- C. obtusatum* Schmidle. Lateral margins with eight to nine undulations and with one to two rows of undulations inside them. Squeezings from Unadilla River, Chenango Co.; Canisteo and Cohocton Rivers, Steuben Co.; Pipe Creek, Tioga Co. Fig. 58.

- C. ornatum* Ralfs. Slightly elevated, truncate apex. Granules on sides and apex. Squeezings of *Anacharis* and *Sphagnum*, Pickerel Pond, Broome Co.; Cincinnatus Lake, Chenango Co.; Stump Lake, Cortland Co. Fig. 62.
- C. pachydemum* var. *aethiopicum* West & West. Walls with fine scribulations and punctuations. Stump Lake, Cortland Co. Fig. 74.
- C. Portianum* Archer. "Dumbell" shaped with prominent granulations. Camp Tuscarora Lake and Harpur Pond, Broome Co.; Stump Lake, Cortland Co. Fig. 68.
- C. protractum* (Naeg.) DeBary. Strainings from Cincinnatus Lake, Chenango Co.; squeezings from Stump Lake, Cortland Co. Fig. 67.
- C. pseudoconnatum* Nordst. Cell wall with fine punctations; chloroplast with four pyrenoids in each semicell. Squeezings of aquatic plants, Pickerel Pond and Camp Tuscarora Lake, Broome Co.; Stump Lake, Cortland Co. Fig. 70.
- C. pseudopyramidatum* Lundell. Similar to *C. pyramidatum* except that it has a single pyrenoid and smaller dimensions. Squeezings from Otsego Lake, Otsego Co. Fig. 53.
- C. punctulatum* Bréb. Cell wall with about 24 granules around margin. In Big Snake Creek, Broome Co.; on dam at Genesetslet Creek, Chenango Co. Fig. 71.
- C. punctulatum* var. *subpunctulatum* (Nordst.) Borg. In *Spagnum*, Pickerel Pond, Broome Co. Fig. 61.
- C. pyramidatum* Bréb. Truncate-pyramidal in shape; two pyrenoids per semicell. Squeezings, Pickerel Pond, Broome Co.; West Branch of Tioughnioga River, Cortland Co. Fig. 60.
- C. quasillus* Lundell. In plankton of both the Chenango and Susquehanna Rivers, Broome Co. Fig. 50.
- C. quinarium* Lund. Winter plankton of Harpur Pond, Broome Co. Fig. 45.
- C. refringens* Taylor. Squeezings, Pickerel Pond, Broome Co.; Otsego Lake, Otsego Co. Fig. 72.
- C. Regnellii* Wille. Cells with small swelling on lateral margins. Fairly widespread throughout area. Fig. 47.
- C. reniforme* (Ralfs) Archer. Granules over entire cell wall, about 25-30 around margin. Camp Tuscarora Lake, Broome Co.; Cincinnatus Lake, Chenango Co. Fig. 56.
- C. sexangulare* var. *minimum* Nordst. A very small cell, ours not over  $17\mu$  in length. Cincinnatus Lake, Chenango Co. Fig. 46.



- C. subcostatum* Nordst. Heavily ornamented with granules and punctations; two pyrenoids per semicell. Distributed throughout several counties of the area in squeezings. Fig. 66.
- C. subcostatum* var. *minor* West & West. Smaller than var. *subcostatum*, fewer lateral crenations and a single pyrenoid. Cohocton River, Steuben Co. Fig. 63.
- C. subreniforme* Nordst. Semicells with two pyrenoids each. Squeezings from Tioughnioga River, Broome Co.; West Branch Tioughnioga River, Cortland Co. Fig. 55.
- C. subtumidum* Nordst. Cell walls finely punctate. Lily Lake and Harpur Pond plankton, Broome Co. Fig. 51.
- C. Turpinii* Bréb. Two central protruberances on each face of semicell and two pyrenoids per semicell are obvious in this species. Squeezings, Susquehanna River, Broome Co.; Stump Lake, Cortland Co.; Owego Creek, Tioga Co. Figs. 65, 69.
- Micrasterias americana* (Ehren.) Ralfs. Polar lobes with secondary processes; cell walls with scattered granules, few in number; two rather prominent spines usually present at base of polar incision. Camp Tuscarora Lake, Broome Co. Fig. 75.
- M. apiculata* var. *fimbriata* forma *spinosa* (Biss.) West & West. Rows of spines along polar, median and lateral incisions prominent. Strainings from Pickerel Pond, Broome Co. Fig. 76.
- M. laticeps* Nordst. Polar lobe broad and rounded. Squeezings, Pickerel Pond, Broome Co.; Stump Lake, Cortland Co. Fig. 77.
- M. Nordstedtiana* Wolle. Polar lobe with secondary processes; cell wall smooth. Tycho plankton of Pickerel Pond, Broome Co. Fig. 78.
- M. pinnatifida* (Kuetz.) Ralfs. Squeezings of aquatics, Pickerel Pond, Broome Co. Fig. 81.
- M. radiata* Hassall. Cells with deep lateral incisions; polar lobe concave; cell wall smooth. Infrequent in squeezings from Pickerel Pond, Broome Co.; Cincinnatus Lake, Chenango Co.; Stump Lake and Tioughnioga River, Cortland Co. Fig. 79.
- M. radiata* var. *simplex* (Wolle) G. M. Smith. Similar to preceding species except lateral lobes simple. Tycho plankton, Pickerel Pond, Broome Co. Fig. 80.
- M. radiosa* Ralfs. Spines absent along margins. Camp Tuscarora Lake, Broome Co. Fig. 85.
- M. radiosa* var. *ornata* Nordst. Identical to species except spines present along some of incisions. Camp Tuscarora Lake and Pickerel Pond, Broome Co. Fig. 89.

- M. rotata* (Grev.) Ralfs. Cells practically circular. Squeezings from Pickerel Pond, Broome Co. Fig. 92.
- M. truncata* var. *semiradiata* Bennett. Polar lobes broad and flattened, cells circular in outline. Variety with longer, finer teeth on lateral lobes. Squeezings, Camp Tuscarora Lake, Broome Co.; common in Stump Lake, Cortland Co.; common in Cohocton River, Steuben Co. Fig. 82.
- Xanthidium antilopaeum* forma *callosum* Cushman. Constrictions pronounced; each semicell with a single central granule. Strainings of Pickerel Pond, Broome Co. Fig. 96.
- X. antilopaeum* var. *minneapolisense* Wolle. Cells with a row of verrucae below each apex; small spine near each row. Irénée-Marie (1938) figures a cell bearing three lateral spines on one semicell and only two on the other. The specimens observed in this study had semicells bearing three lateral spines on one side and four on the other. Plankton of Harpur Pond and Camp Tuscarora Lake, Broome Co. Fig. 95.
- X. antilopaeum* var. *polymazum* Nordst. Similar to preceding variety but lacking the spine below the row of subapical verrucae. Squeezings from Pickerel Pond and plankton of Harpur Pond, Broome Co. Fig. 98.
- X. cristatum* var. *uncinatum* Bréb. Lateral walls concave between spines; apex truncate; granules in central area. Tychoplankton, Pickerel Pond, Broome Co. Fig. 99.
- X. subhastiferum* West & West. Typical cells have two spines on same vertical plane on lateral margins. Our specimens frequently with supplementary spines on the apices. Plankton, Harpur Pond, Broome Co. Fig. 93.
- Staurastrum alternans* Bréb. Small cell, triangular in apical view; arms of one semicell alternating with the arms of the other. Plankton of Tioughnioga River, Broome Co. Fig. 146.
- S. apiculatum* Bréb. Small cells tipped with short upright spines. Squeezings from Pickerel Pond, Broome Co.; Oak Creek, Otsego Co. Fig. 91.
- S. Arctiscon* (Ehren.) Lundell. Semicells with two whorls of processes, nine in median position and six in apical position. Squeezings, strainings, and in floating debris, Pickerel Pond, Broome Co.; Stump Lake, Cortland Co.; Otsego Lake, Otsego Co.; Owego Creek, Tioga Co. Fig. 120.
- S. Arctiscon* var. *glabrum* West & West. Same as above except arms a little shorter and without granules. Squeezings of *Sparganium*

- and *Anacharis* stems, Camp Tuscarora Lake, Broome Co.; common in Stump Lake, Cortland Co. Fig. 117.
- S. brasiliense* var. *Lundellii* West & West. A striking desmid! Vertical view usually five-sided; arms tipped with three long, stout spines measuring  $30-40\mu$  in length. Strainings and squeezings from Pickerel Pond, Broome Co. Fig. 111.
- S. Brebissonii* var. *brevispinum* W. West. Spines on most of cell wall but absent from apices. Tycho plankton, Little Snake Creek, Broome Co.; Genegantslet Creek, Chenango Co. Fig. 101.
- S. crenulatum* (Naeg.) Delponte. Two verrucae at the concave base of each arm in vertical view. Squeezings of aquatics from Pickerel Pond, Broome Co. Fig. 103.
- S. cuspidatum* Bréb. Constriction deep and isthmus elongate; single, straight, sharp spine terminating each arm. Entangled with debris about aquatic stems, Pickerel Pond, Broome Co. Fig. 87.
- S. cuspidatum* var. *canadense* G. M. Smith. Variety differs from species with its distinct notch at the isthmus and somewhat divergent spines. *Sphagnum* squeezings from Pickerel Pond, Broome Co. Fig. 115.
- S. Dickiei* Ralfs. Similar to *S. cuspidatum* but without elongate isthmus and with shorter spines. *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 94.
- S. Dickiei* var. *circulare* Turner. Variety has apical margin greatly rounded, almost semicircular. Tycho plankton, Pickerel Pond, Broome Co. Fig. 97.
- S. Dickiei* var. *rhomboideum* West & West. This variety has straight lateral sides. Tycho plankton, Pickerel Pond, Broome Co. Fig. 88.
- S. dilatatum* Ehren. Cells usually quadrangular in vertical view; wall with concentrically arranged granules. *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 104.
- S. furcigerum* Bréb. Angles of semicells with two rows of processes tipped with spines and bearing granules. Plankton of Harpur Pond, Broome Co. Fig. 114.
- S. furcigerum* forma *eustephana* (Ehren.) Nordst. This form has six processes in an apical row, instead of three. Plankton of Pond 1, Broome Co. Fig. 112.
- S. grande* var. *parvum* W. West. In squeezings of *Anacharis* stems, Stump Lake, Cortland Co. Fig. 83.
- S. illusum* var. *major* Irénée-Marie. This taxon differs from *S. alternans* by its less rounded, nonalternating angles. Squeezings,



Little Snake Creek, Broome Co.; Cincinnatus Lake, Chenango Co.; Stump Lake, Cortland Co. Fig. 145.

*S. Johnsonii* West & West. Cells with two rows of granules at basal inflation; one row of tubercles at apex. In *Sphagnum* border of Pickerel Pond, Broome Co. Fig. 116.

*S. longiradiatum* West & West. Semicells with basal inflation and terminal verrucae. Plankton of Susquehanna River, Broome Co. Fig. 110.

*S. muticum* Bréb. Small cells with broadly rounded angles; isthmus narrow. Squeezings of Genegantslet Creek, Chenango Co. Fig. 84.

*S. Ophiura* Lundell. A large beautiful desmid especially in vertical view. Usually seven-rayed; each ray with short sharp spines near apical ends and verrucae near basal ends; rays tipped with three spines. Camp Tuscarora Lake, Broome Co. Fig. 102.

*S. pachyrhynchum* Nordst. Lateral angles broadly rounded and walls quite thickened at the angles. Squeezings from Pickerel Pond, Broome Co. Fig. 86.

*S. polymorphum* Bréb. Small cells bearing three to seven arms on each semicell. Each arm terminated by three to four short spines and each arm with three to four series of granules. Squeezings from Cincinnatus Lake and Genegantslet Creek, Chenango Co. Fig. 106.

*S. pseudopelagicum* West & West. Constriction deep and sinus acute; angles of semicells with long divergent processes, tipped with divergent spines. Squeezings, Cincinnatus Lake, Chenango Co. Fig. 107.

*S. pseudopelagicum* var. *minor* G. M. Smith. The species has cells 40-60 $\mu$  long, the variety is 30-38 $\mu$  in length. In ours, some processes were terminated by three spines, others by two. Cincinnatus Lake, Chenango Co. Fig. 108.

*S. punctulatum* Bréb. Lateral angles somewhat pointed; cell wall granular. Plankton of Pond 1, Broome Co. Fig. 90.

*S. rugosum* Irénée-Marie. Short plump cells with very short angles; prominent granules arranged concentrically but lacking on the apex. Squeezings from Otsego Lake, Otsego Co. Fig. 109.

*S. setigerum* Cleve. Two sizes of spines are distinctive; three large vertically arranged spines on angles and more delicate, smaller spines on margins. *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 105.

- S. tetracerum* Ralfs. Very small biradiate cells, twisted at their isthmus. Tychoplankton of Pickerel Pond, Broome Co. Fig. 100.
- S. tetracerum* var. *evolutum* West & West. This triradiate variety is much larger than the species and has long processes. Frequent in summer plankton of the Chenango and Susquehanna Rivers, Broome Co. Fig. 113.
- Onychonema laeve* var. *latum* West & West. Apices of cells with short, truncate elevation; filaments often enclosed in gelatinous envelope. Squeezings of *Sparganium* stems, Camp Tuscarora Lake, Broome Co. Fig. 118.
- Sphaerosoma excavatum* var. *subquadratum* West & West. Cells H-shaped with short, uniting, apical processes. Lateral lobes with minute granules on margins only, none on face. Camp Tuscarora Lake, Broome Co.; Cincinnatus Lake, Chenango Co. Fig. 125.
- S. granulatum* Roy & Biss. Lateral lobes with granules on margin and face of semicell. Squeezings of Pickerel Pond, Broome Co.; Genegantslet Creek, Chenango Co. Fig. 127.
- Spondylosium planum* (Wolle) West & West. Apical processes lacking in this genus, cell wall smooth. Squeezings of aquatics from Pickerel Pond, Broome Co.; Cincinnatus Lake, Chenango Co. Fig. 124.
- Hyalotheca dissiliens* (J. E. Smith) Bréb. Filaments with wide gelatinous envelope; cell wall smooth, constriction weak and not too apparent. Squeezings from Harpur Pond, Camp Tuscarora Lake, and Pickerel Pond, Broome Co.; Otsego Lake, Otsego Co. Fig. 123.
- H. undulata* Nordst. Cells longer than broad, appearing undulate along their margins; sheath weak or lacking. *Sphagnum* squeezings, Pickerel Pond, Broome Co. Fig. 126.
- Desmidium Baileyi* (Ralfs) Nordst. Filaments in gelatinous sheath, twisted; cells concave at apices, mostly triangular in vertical view. Squeezings of *Sphagnum* and *Pontederia*, Pickerel Pond, Broome Co. Fig. 119.
- D. Grevillei* (Kuetz.) DeBary. Apices not concave; vertical view elliptic. Camp Tuscarora Lake, Broome Co. Fig. 128.
- D. Swartzii* C. A. Agardh. Apices not concave; vertical view triangular. Tychoplankton, Harpur Pond, Pickerel Pond, and Camp Tuscarora Lake, Broome Co. Fig. 122.
- Gymnozyga moniliformis* Ehren. Filaments composed of barrel-shaped cells, often in gelatinous sheath. *Sphagnum* and *Pontederia* squeezings, Pickerel Pond, Broome Co. Fig. 121.

## EUGLENOPHYTA

## EUGLENOPHYCEAE

## EUGLENALES

## EUGLENACEAE

*Euglena acus* Ehren. Long thin cells tapering to an acute posterior tip, firm shape,  $150\mu$  long. Plankton, August, Harpur Pond, Broome Co.

*E. oxyuris* Schmarda. Longitudinal striations of periplast, anterior groove and two annular, elongated paramylon bodies easily seen; cell  $170\mu$  long. Plankton, June, Susquehanna River, Broome Co.

*Phacus curvicauda* Swirendo. Cells ovoid, twisted slightly posteriorly; short, oblique caudus. August, with green algae on rocks, Chenango River, Broome Co.

*P. longicauda* (Ehren.) Dujardin. Cells ovoid, tapering to an acute caudus as long as the main body of the cell; overall length  $88\mu$ . Plankton, Chenango River, Broome Co.

*P. pleuronectes* (Mueller) Dujardin. Cells suborbicular with short, heavy caudus that is sharp and oblique; periplast longitudinally striated. Squeezings, from West Branch Tioughnioga River, Cortland Co.

*P. tortus* (Lemm.) Skvortzow. Fusiform cells; spirally tapering and twisting to long, straight caudus; periplast longitudinally striated. Rare in mud, West Branch Tioughnioga River, Cortland Co.

*Trachelomonas euchlors* (Ehren.) Lemmermann. Brown cylindrical test with truncate ends. Squeezings, from Oak Creek, Otsego Co.

## CHRYSTOPHYTA

## XANTHOPHYCEAE

## RHIZOCHLORIDALES

## STIPITOCOCCACEAE

*Stipitococcus apiculatus* Prescott. Infrequent on *Coelosphaerium*, a blue-green and *Asterionella*, a diatom. This epiphyte and its long stipe is easily spotted. September, Susquehanna plankton; November, Chenango plankton, Broome Co. Fig. 138.

*HETEROSIPHONALES**BOTRYDIACEAE*

*Botrydium granulatum* (L.) Grev. Dark green beads up to several millimeters in diameter common on damp mud of shores, October, Susquehanna River, Broome Co. Fig. 148.

*VAUCHERIACEAE*

*Vaucheria* sp. Vegetative material collected on mud, in small pools, and attached to rocks in shallow water of streams in Broome and Cortland Cos.

*CHRYSOPHYCEAE**CHRYSOMONADALES**MALLOMONADACEAE*

*Mallomonas acaroides* var. *moskovensis* (Wermel) Kreiger. Anterior needles pointing forward and curved outwards, median and other needles toward posterior. Plankton, Susquehanna River, Broome Co.

*M. caudata* Iwanoff. Needles distributed all over cell and directed backward. Plankton, Chenango River, Broome Co.

*SYNURACEAE*

*Synura uvella* Ehren. This free-swimming, colonial alga is found frequently in the plankton and squeezings of streams and lakes throughout the area. In the Chenango and Susquehanna Rivers it can be collected at most times of the year; however, it is at its lowest during the warm summer months and at its greatest abundance in spring.

*OCHROMONADACEAE*

*Dinobryon bavaricum* Imhof. Loricas with undulate sides and long tapering base. Plankton and squeezings, Pickerel Pond, Camp Tuscarora Lake, and Chenango River, Broome Co.

*D. divergens* Imhof. Only lower half of loricas undulate; mouth flaring; base short. Plankton, during late summer and autumn, Ponds 1 and 2, Susquehanna River, Broome Co.

*D. sertularia* Ehren. Loricas usually with an asymmetrical swelling near base. Frequent to common in winter and spring plankton, rare at other times, Ponds 1 and 2, Chenango and Susquehanna River, Broome Co.

*D. sociale* var. *americanum* (Brunnthaler) Bachmann. Loricas short and stout, colonies loose and spreading. Spring plankton, Susquehanna River, Broome Co.

## RHIZOCHRYSIDALES

### RHIZOCHRYSIDACEAE

*Chrysidiastrium catenatum* Lauterborn. Cells with four small tapering projections, each terminating with a long fine seta. Rare in plankton of Boland Pond, Broome Co.

*Lagynion ampullaceum* (Stokes) Pascher. Epiphytic on cells of *Cladophora*. Lorica flask shape, body of cell globose. Meade Creek, Steuben Co. Fig. 136.

*L. macrotrachelum* (Stokes) Pascher. Lorica depressed and flattened against the cells of *Tolypothrix tenuis*, summer, Stump Lake, Cortland Co. Fig. 135.

### BACILLARIOPHYCEAE\*

## CENTRALES

### COSCINODISCACEAE

*Melosira* sp. Frequent bits and fragments found in spring plankton of Chenango and Susquehanna Rivers, Broome Co. Probably one of the following species.

*M. crenulata* (Ehren.) Kuetz. In plankton of Chenango River, Broome Co., especially abundant in the fall.

*M. italica* (Ehren.) Kuetz. Frequent in spring populations of Susquehanna River, Broome Co.

*Stephanodiscus niagarae* Ehren.\* Common in plankton of Susquehanna River, May and June, Broome Co.

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\*Those diatoms marked with an asterisk were also reported by Hohn (1951).

## PENNALES

## TABELLARIACEAE

*Tabellaria fenestrata* (Lyngb.) Kuetz. Frequent in April and May plankton in Ponds 1 and 2, Broome Co.

*T. floccosa* (Roth) Kuetz. In spring plankton of Chenango and Susquehanna Rivers, Broome Co.

## MERIDIONACEAE

*Meridion circulare* (Greville) C. A. Agardh. Frequent in net plankton of Chenango and Susquehanna Rivers during April and May, Broome Co.

## DIATOMACEAE

*Diatoma vulgare* Bory. Frequent in April and May, common in June plankton, Chenango and Susquehanna Rivers, Broome Co.

## FRAGILARIACEAE

*Fragilaria capucina* Desmazieres. Infrequent in plankton of April collections from Chenango and Susquehanna Rivers, Broome Co.

*F. crotonensis* Kitton. Common in spring and early summer, again in the fall plankton Susquehanna River, Broome Co.

*F. Harrisonii* (W. Smith) Grun.\* Susquehanna River, Tioga Co.

*F. virescens* Ralfs. Infrequent in spring plankton, Susquehanna River, Broome Co.

*Synedra pulchella* (Ralfs) Kuetz. Plankton, Chemung River, Chemung Co.

*S. ulna* (Nitzsch) Ehren. Present most of the year, most common in spring and early summer, Susquehanna River, Broome Co.

*S. ulna* var. *chaseana* Thomas. Abundant in April counts, Susquehanna River, Broome Co.

*Asterionella formosa* Hassall. Infrequent, spring and fall plankton, Susquehanna River, Broome Co.

*A. gracillima* (Hantzsch) Heiberg. Very common, especially during spring months, Susquehanna River; abundant in Pond 2 in winter, Broome Co.

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\*Those diatoms marked with an asterisk were also reported by Hohn (1951).



## ACHNANTHACEAE

- Rhoicosphenia curvata* (Kuetz.) Gron.\* Rare, May plankton, Susquehanna River, Broome Co.  
*Cocconeis pediculus* Ehren.\* Epiphytic on filamentous greens, May, Susquehanna River, Broome Co.  
*C. placentula* Ehren.\* Susquehanna River, Tioga Co.

## NAVICULACEAE

- Navicula americana* var. *minor* Perag & Haribaud.\* Plankton, Susquehanna River, Tioga Co.  
*N. bacillum* Ehren.\* Plankton, Susquehanna River, Broome Co.  
*N. cuspidata* Kuetz.\* Plankton, Susquehanna River, Tioga Co.  
*N. mutica* Kuetz.\* Plankton, Susquehanna River, Tioga Co.  
*N. viridula* Kuetz.\* Plankton, Susquehanna River, Tioga Co.  
*Pinnularia borealis* Ehren.\* Plankton, Susquehanna River, Tioga Co.  
*P. divergens* W. Smith.\* Plankton, Susquehanna River, Tioga Co.  
*P. gibba* Ehren.\* Plankton, Susquehanna River, Tioga Co.  
*P. legumen* Ehren.\* Plankton, Susquehanna River, Tioga Co.  
*P. nobilis* Grun.\* Plankton, Susquehanna River, Tioga Co.  
*P. mesolepta* Ehren.\* Plankton, Susquehanna River, Tioga Co.  
*P. subcapitata* Greg.\* Plankton, Susquehanna River, Tioga Co.  
*P. viridis* (Nitzsch) Ehren.\* Plankton, Susquehanna River, Tioga Co.  
*Caloneis amphisbaena* (Bory) Cleve.\* Plankton, Susquehanna River, Tioga Co.  
*Neidium affine* var. *amphirhynchus* (Ehren.) Clev.\* Plankton, Susquehanna River, Tioga Co.  
*N. productum* (W. Smith) Cleve.\* Plankton, Susquehanna River, Tioga Co.  
*Stauroneis phoenicenteron* Ehren.\* Plankton, Susquehanna River, Tioga Co.  
*Tropidoneis lepidoptera* (Greg.) Cleve.\* Plankton, Susquehanna River, Tioga Co.  
*Frustulia rhomboides* (Ehren.) DeToni.\* Plankton, Susquehanna River, Tioga Co.

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\*Those diatoms marked with an asterisk were also reported by Hohn (1951).

*Gyrosigma attenuatum* (Kuetz.) Cleve. Infrequent in plankton, March and April; some infected with Chytrids. Plankton, Susquehanna River, Broome Co.

*G. scalproides* (Raben.) Cleve.\* Plankton, Susquehanna River, Tioga Co.

*Amphiprora* sp. Only a single cell seen in May collection, lost before species identification could be made. Susquehanna River, Broome Co.

### GOMPHONEMATACEAE

*Gomphonema Augur* Ehren.\* Susquehanna River, Tioga Co.

*G. sphaerophorum* Ehren.\* Susquehanna River, Tioga Co.

*G. ventricosum* Greg.\* Susquehanna River, Tioga Co.

*Gomphoneis herculeana* (Ehren.) Cleve.\* Susquehanna River, Tioga Co.

*G. herculeana* var. *robusta* (Grunov) Cleve.\* Excellent cells seen in plankton collections during May, Susquehanna River, Broome Co.

### CYMBELLACEAE

*Cymbella affinis* Kuetz.\* Plankton, Susquehanna River, Tioga Co.

*C. cuspidata* Kuetz.\* Plankton, Susquehanna River, Tioga Co.

*C. mexicana* Ehren.\* Plankton, Susquehanna River, Tioga Co.

*C. sinuata* Greg.\* Plankton, Susquehanna River, Tioga Co.

*C. tumida* (Bréb.) Van Heurck.\* Infrequent in spring collections, Susquehanna River, Broome and Tioga Co.

*C. ventricosa* Kuetz.\* Plankton, Susquehanna River, Tioga Co.

*Amphora veneta* Kuetz.\* Plankton, Susquehanna River, Tioga Co.

*Epithemia zebra* (Ehren.) Kuetz.\* Plankton, Susquehanna River, Tioga Co.

### NITZSCHIACEAE

*Nitzschia sigmoidea* (Nitzsch) W. Smith. Infrequent in winter and spring plankton; beautiful large cells during May collections. Susquehanna River, Broome and Tioga Counties.

*Hantzschia amphioxys* (Ehren.) Grun.\* Plankton, Susquehanna River, Tioga Co.

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\*Those diatoms marked with an asterisk were also reported by Hohn (1951).



### SURIPELLACEAE

- Cymatopleura elliptica* (Bréb.) W. Smith.\* Plankton, Susquehanna River, Tioga Co.
- C. solea* (Bréb.) W. Smith.\* Spring plankton, Susquehanna River, Broome and Tioga Counties.
- Surirella biseriata* var. *bifrons* (Ehren.) Hurst.\* Plankton, Susquehanna River, Tioga Co.
- S. guatamalensis* Ehren.\* Plankton, Susquehanna River, Tioga Co.
- S. pinnata* W. Smith.\* Plankton, Susquehanna River, Tioga Co.
- S. spiralis* Kuetz.\* Spring plankton; Susquehanna River, Broome Co.
- S. tenera* Greg. Winter collection, Susquehanna River, Broome Co.
- S. tenera* var. *nevosa* A. Schmidt.\* Plankton, Susquehanna River, Tioga Co.

### PYRROPHYTA

#### DINOPHYCEAE

#### PERIDINIALES

#### PERIDINIACEAE

- Peridinium gatunense* Nygaard. A most important member of the plankton population in Ponds 1 and 2. Common to abundant, February through April. Broome Co.
- P. wisconsinense* Eddy. Infrequent in summer collections, *Sphagnum* border, Pickerel Pond, Broome Co.

#### CERATIACEAE

- Ceratium hirundinella* (O. F. Muell.) Dujardin. Spring and summer plankton samples, Susquehanna River, Broome Co.; Cincinnatus Lake, Chenango Co.; Tioughnioga River, Cortland Co.

#### DINOCOCCALES

#### PHYTODINIACEAE

- Stylodinium globosum* Klebs. An extremely rare alga. Thompson (1949) reports this species from Maryland on *Oedogonium* during

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\*Those diatoms marked with an asterisk were also reported by Hohn (1951).

September. I found it on *Oedogonium* filaments during September. Excellent material, fitting Thompson's description in every way. This immobile Dinophycean has a globular cell  $30\mu$  in diameter, a stipe  $25\mu$  long and a disc-like holdfast  $10\mu$  in diameter. On *Oedogonium*, in debris along edge of shore, Little Choconut Creek, Broome Co. Fig. 141.

## CYANOPHYTA

### MYXOPHYCEAE

### CHROOCOCCALES

### CHROOCOCCACEAE

- Chroococcus dispersus* (Keissl.) Lemmermann. Small cells,  $3-5\mu$  in diameter. In squeezings of aquatics, Tioughnioga River, Broome Co.
- C. minimus* (Keissl.) Lemmermann. Large colonies of very small cells,  $2-3\mu$  wide. In floating debris, Tioughnioga River, Broome Co.
- C. minutus* (Kuetz.) Naegeli. Cells  $5-10\mu$  wide. Tychoplankton, West Branch Tioughnioga River, Cortland Co.; Otsego Lake, Otsego Co.
- C. turgidus* (Kuetz.) Naegeli. Very large cells with hyaline, lamellated sheaths. Squeezings, Pickerel Pond and Lily Lake, Broome Co.
- Aphanocapsa elachista* West & West. Plankton colonies of pale, blue-green cells. Stump Lake, Cortland Co.
- A. Grevillei* (Hass.) Raben. Cells  $4-5.5\mu$ , close, blue-green and with pseudovacuoles. Entangled with aquatic plants, Pickerel Pond, Broome Co.
- A. rivularis* (Carm.) Raben. Cells scattered, granular,  $5-6\mu$  in diameter. On scrapings of dam boards, Genegantslet Creek, Chenango Co.
- A. pulchra* (Kuetz.) Raben. Cells finely-granular, not crowded. Tychoplankton, Pickerel Pond, Broome Co.
- Anacystis cyanea* Drouet & Daily. (*Microcystis aeruginosa* Kuetz.) Frequent young colonies seen during April and May, older larger colonies seen with frequency during summer, Susquehanna River, Broome Co.; Stump Lake, Cortland Co.

- A. incerta* (Lemm.) Drouet & Daily. (*Microcrocystis incerta* Lemm.) Squeezings, Pickerel Pond, Broome Co.; Stump Lake, Cortland Co.
- Aphanothece nidulans* P. Richter. Entangled with attached filaments in water of Tioughnioga River, Broome Co.
- A. stagnina* (Spreng.) A. Braun. In squeezings of *Sphagnum*, Pickerel Pond, Broome Co.
- Merismopedia elegans*. A. Braun. Cells bright blue-green, approximately  $6 \times 8\mu$ . Fairly widespread throughout the area, primarily in tychoplankton.
- M. glauca* (Ehren.) Naegeli. Homogeneous cells,  $4-7\mu$  in diameter. Quite widespread in tychoplankton.
- M. punctata* Meyen. In floating debris, Tioughnioga River, Broome Co.
- M. tenuissima* Lemmermann. In squeezings, scrapings, and floating debris throughout the area.
- M. Trolleri* Bachmann. Refraction of light on pseudovacuoles causes cells to appear orange, brown, purple, etc. A rare blue-green in squeezings of *Anacharis*, Cincinnatus Lake, Chemung Co.
- Coelosphaerium dubium* Grunow. Spherical cells  $5-7\mu$  densely packed. Squeezings from Owego Creek, Tioga Co.
- C. Kuetzingianum* Naegeli. Cells round, small,  $4\mu$  or less. Squeezings and strainings from Cincinnatus Lake and Genegantslet Creek, Chenango Co.; West Branch Tioughnioga River, Cortland Co.
- C. Naegelianum* Unger. Cells ovate — ellipsoid, granular. Quite common and widespread, becoming abundant in months of August and September in the Chenango and Susquehanna Rivers, Broome Co.
- Gomphosphaeria aponina* Kuetz. Cells pyriform at ends of radiating strands within gelatinous envelope. Squeezings, Otsego Lake, Otsego Co.

## CHAMAESIPHONALES

### CHAMAESIPHONACEAE

- Entophysalis lemaniae* (Ag.) Drouet & Daily. (*Chamaesiphon in-crustans* Grun.). A small inconspicuous epiphyte on green filamentous algae, Susquehanna River, Otsego Co. Fig. 133.

## OSCILLATORIALES

## OSCILLATORIACEAE

- Spirulina princeps* (West & West) G. West. Single celled, spiral trichome, 4-5 $\mu$  wide. Plankton, Tioughnioga River, Broome Co.
- Oscillatoria Agardhii* Gomont. Briefly tapered trichomes with granular cell walls. Tychoplankton, Genegantslet Creek and Unadilla River, Chenango Co.
- O. amphibia* C. A. Agardh. Forming small sheets on dam and aquatic plants. Cells with a single granule on either side of cross wall. Genegantslet Creek, Chenango Co.
- O. anguina* (Bory) Gomont. Trichomes curved at apex, apical cell capitate. Forming mat on mud bottom, West Branch Tioughnioga River, Cortland Co.
- O. angustissima* West & West. Extremely small trichomes, 1 $\mu$  or less in diameter; cells only 1-3 $\mu$  in length. Tychoplankton, Unadilla River, Chenango Co.; Stump Lake, Cortland Co.
- O. chlorina* Kuetz. Protoplast yellowish-green, barely granular. On mud bottom, Pickerel Pond, Broome Co.
- O. curviceps* C. A. Agardh. Trichomes twisted terminally; not constricted at cross walls. Tychoplankton, Camp Tuscarora Lake, Broome Co.; Oak Creek, Otsego Co.
- O. geminata* Meneghini. Terminal cell rounded; cells constricted at cross walls and containing one or two large vacuoles. Strainings, Pickerel Pond, Broome Co.
- O. limnetica* Lemmermann. Cross walls barely visible and not constricted. Plankton of Pickerel Pond and Tioughnioga River, Broome Co.; Canisteo River, Steuben Co.
- O. limosa* (Roth) C. A. Agardh. Trichomes straight, not tapered; cross walls granulate and not constricted. Common and widespread throughout area.
- O. princeps* Vaucher. Trichomes very large, 30-60 $\mu$  in diameter; cells heavily granular. Widespread in most counties of area.
- O. proboscidea* Gomont. Trichomes tapering, ending in a capitate, truncate cell; trichomes loosely spiraled. Rare on mud bottom West Branch Tioughnioga River, Cortland Co.
- O. sancta* (Kuetz.) Gomont. Cells dark grey-green, turning violet if dried; cross walls granular. Widespread on aquatics, mud bottoms, rocks, and dams.

- O. splendida* Greville. Trichomes gradually tapering over a long distance, solitary; cross walls with granules. Infrequent in squeezings, Oak Creek, Otsego Co.
- O. tenuis* C. A. Agardh. Trichomes not tapering, cells 5-10 $\mu$  wide, granular, blue-green; cross walls granular. The most widespread of all *Oscillatoria*, found everywhere.
- Lyngbya Nordgaardii* Wille. A most peculiar *Lyngbya*, many of its cells attach to filamentous greens and follow its host for awhile, then its terminal cells break away curving upward; cells square, 1.5 $\mu$ ; sheath thin. Susquehanna River, Otsego Co. Fig. 142.
- L. putealis* Montagne. Sheaths thin; filaments forming a mat almost black in color; cells 4-10 $\mu$  and square. Pond 1, Broome Co.
- Microcoleus paludosus* (Kuetz.) Gomont. Several twisted filaments with a common sheath; cells light blue-green, not constricted. On mud, Pickerel Pond, Broome Co.

### NOSTOCACEAE

- Anabaena affinis* Lemmermann. Cells 5-7 $\mu$  wide; heterocysts spherical, 7-10 $\mu$ . Tycho plankton, Pickerel Pond, Broome Co.; Stump Lake, Cortland Co.
- A. Bornetiana* Collins. Cells 11-12 $\mu$ ; heterocysts 12-14 $\mu$ ; gonidia 12 $\mu$  x 50-80 $\mu$ . Squeezings of *Sphagnum*, Pickerel Pond, Broome Co.
- A. sphaerica* Bornet & Flahault. Cells 5-6 $\mu$ ; heterocysts 6-7 $\mu$ ; gonidia 12-18 $\mu$ ; spherical and contiguous to heterocysts. Canisteo River, Steuben Co.
- A. spiroides* var. *crassa* Lemmermann. Trichomes spiral; cells 11-15 $\mu$ , heterocysts 10-15 $\mu$ ; gonidia 20-23 $\mu$  x 25-40 $\mu$ . Common to very abundant, July through September, Chenango and Susquehanna Rivers, Broome Co.
- A. variabilis* Kuetz. Cells 4-6 $\mu$  x 3-6 $\mu$ ; heterocysts 6-8 $\mu$ ; gonidia 6-10 $\mu$  x 8-15 $\mu$ , in series. Tycho plankton, Stump Lake, Cortland Co.
- Anabaenopsis Elenkinii* Miller. Excellent filaments, all with terminal heterocysts. In Harpur Pond, Broome Co.
- Aphanizomenon flos-aquae* (L.) Ralfs. Straight trichomes arranged laterally in bundles within a mucilaginous sheath; trichomes tapering towards both ends. Common in plankton of Susquehanna, April through July, Broome Co.

*Cylindrospermum muscicola* Kuetz. Trichomes with terminal heterocysts and gonidia adjacent to heterocysts; gonidia ellipsoidal. Tychoplankton, Canisteo River, Steuben Co.

*C. stagnale* (Kuetz.) Bornet & Flahault. Similar to preceding species, but gonidia cylindrical, up to  $40\mu$  in length. On mud bottom, Little Choconut Creek, Broome Co.

### SCYTONEMATACEAE

*Tolypothrix distorta* Kuetz. Filaments with false lateral branches; cells broader than long,  $9-12\mu \times 6-8\mu$ . Tychoplankton, Lily Lake and Pickerel Pond, Broome Co.

*T. tenuis* Kuetz. Similar to the above but with cells square or slightly longer than broad,  $5-8\mu$  wide. Squeezings, Harpur Pond and Pickerel Pond, Broome Co.; Stump Lake, Cortland Co.

### STIGONEMATACEAE

*Nostochopsis lobatus* Wood. Trichomes freely branched within a macroscopic gelatinous matrix; cells usually barrel-shaped; heterocysts mostly terminal on lateral branches. Small gelatinous beads free-floating and attached on rocks, Susquehanna River, Chenango Co. Fig. 144.

### RIVULARIACEAE

*Calothrix* sp. Filaments attached to stones and boards, Pickerel Pond, Broome Co.

*C. fusca* Bornet & Flahault. Filaments mostly solitary, tapering to fine long apices from a broad swollen base; strongly curved; heterocysts basal; sheaths thick and lamellose. In debris along shore, Little Choconut Creek, Broome Co.

*C. parietana* (Naeg.) Thuret. Filaments single or in mats; tapering to attenuated apices; sheaths thick and lamellose, filaments not swollen at base. Stump Lake, Cortland Co.

*Gloeotrichia pisum* (C. A. Agardh) Thuret. Trichomes radiating from center of macroscopic gelatinous ball, tapering to attenuated apices; heterocysts basal. Frequent on *Sparganium* stems, Stump Lake, Cortland Co.



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## ILLUSTRATIONS

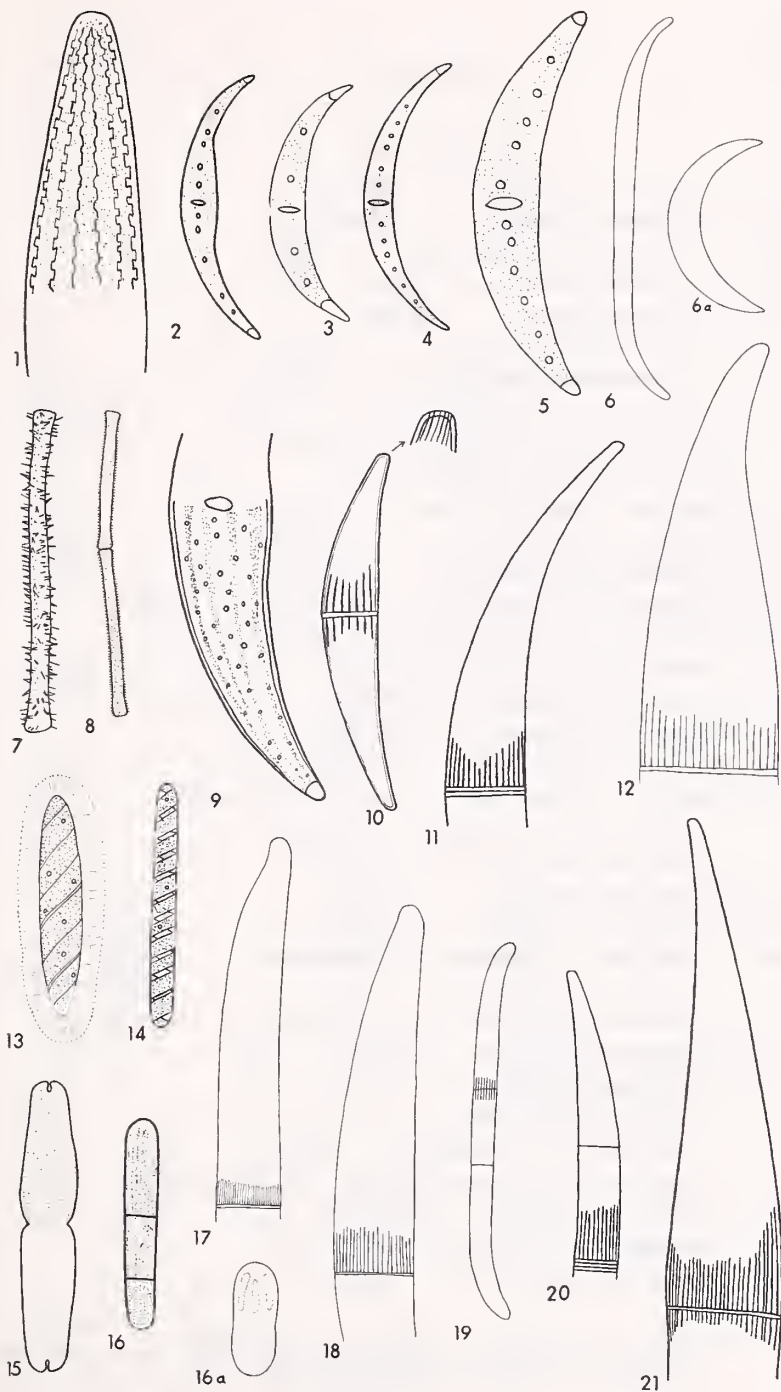
## PLATE I

Figs. 1-21\*

1. *Netrium digitus* . . . 130x35.
2. *Closterium Leibleinii* . . . 150x20.
3. *Closterium Venus* . . . 68x9.
4. *Closterium Dianae* . . . 172x17.
5. *Closterium moniliferum* . . . 290x61.
6. *Closterium gracile* . . . 150x4.
- 6a. *Closterium incurvum* . . . 60x13.
7. *Gonatozygon aculeatum* . . . 208x14.
8. *Gonatozygon pilosum* . . . 115x10.
9. *Closterium Ehrenbergii* . . . 350x65.
10. *Closterium costatum* . . . 228x38.
11. *Closterium Ralfsii* var. *hybridum* . . . 460x47.
12. *Closterium Ralfsii* . . . 520x54.
13. *Spirotaenia obscura* . . . 145x23.
14. *Spirotaenia condensata* . . . 155x18.
15. *Tetmemorus Brebissonii* . . . 185x23.
16. *Penium margaritaceum* . . . 137x20.
- 16a. *Penium spinospermum* . . . 33x14.
17. *Closterium turgidum* . . . 730x58.
18. *Closterium striolatum* . . . 248x32.
19. *Closterium juncidium* . . . 235x9.
20. *Closterium intermedium* . . . 200x26.
21. *Closterium Ralfsii* var. *immane* . . . 600x72.

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\*Numbers after each taxon indicate the actual overall length and width measurements in microns of the cell figured.



## PLATE II

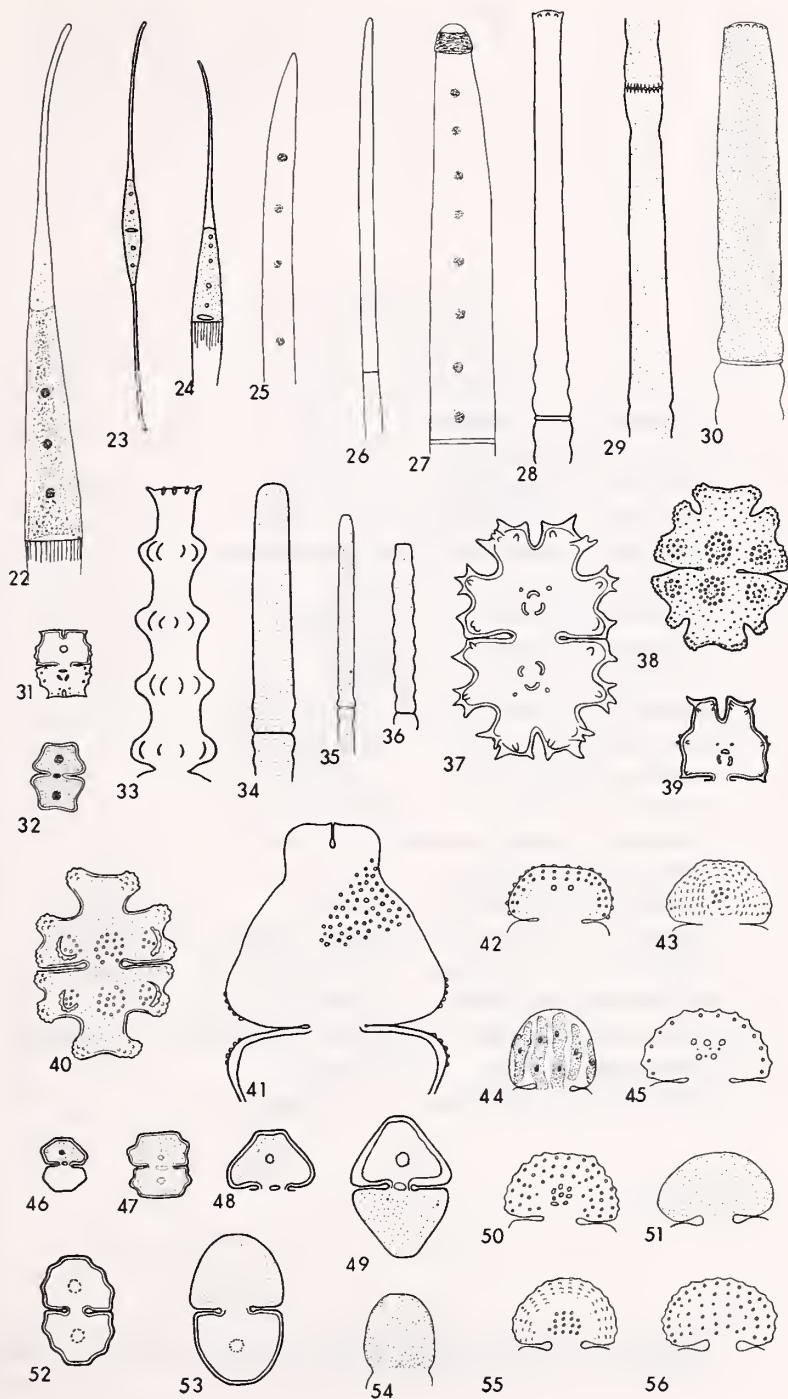
Figs. 22-56\*

22. *Closterium rostratum* . . . 350x25.
23. *Closterium setaceum* . . . 263x8.
24. *Closterium Kuetzingianum* . . . 172x17.
25. *Closterium acutum* . . . 150x9.
26. *Closterium toxon* . . . 322x9.
27. *Closterium didymotocum* . . . 540x58.
28. *Pleurotaenium Ehrenbergii* . . . 596x24.
29. *Pleurotaenium subcoronulatum* var. *detum* . . . 405x23.
30. *Pleurotaenium coronatum* . . . 602x66.
31. *Euastrum abruptum* forma *minor* . . . 22x17.
32. *Euastrum binale* var. *hians* . . . 12x10.
33. *Pleurotaenium nodosum* . . . 960x65.
34. *Pleurotaenium trabecula* . . . 324x23.
35. *Pleurotaenium trabecula* var. *rectum* . . . 240x11.
36. *Pleurotaenium nodulosum* . . . 390x57.
37. *Euastrum evolutum* . . . 70x42.
38. *Euastrum verrucosum* var. *alatum* . . . 103x87.
39. *Euastrum abruptum* . . . 36x24.
40. *Euastrum gemmatum* . . . 50x37.
41. *Euastrum obesum* var. *crassum* . . . 119x66.
42. *Cosmarium bipunctatum* . . . 20x18.
43. *Cosmarium Botrys* var. *subtumidum* . . . 60x45.
44. *Cosmarium cucumis* . . . 75x45.
45. *Cosmarium quinarium* . . . 40x34.
46. *Cosmarium sexangulare* var. *minimum* . . . 16x13.
47. *Cosmarium Regnellii* . . . 17x17.
48. *Cosmarium Hammeri* var. *protuberans* . . . 32x25.
49. *Cosmarium granatum* . . . 35x27.
50. *Cosmarium quasillus* . . . 60x45.
51. *Cosmarium subtumidum* . . . 42x33.
52. *Cosmarium impressulum* . . . 28x20.
53. *Cosmarium pseudopyramidatum* . . . 42x27.
54. *Cosmarium cucurbita* . . . 29x18.
55. *Cosmarium subreniforme* . . . 39x38.
56. *Cosmarium reniforme* . . . 60x55.

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\*Numbers after each taxon indicate the actual overall length and width measurements in microns of the cell figured.





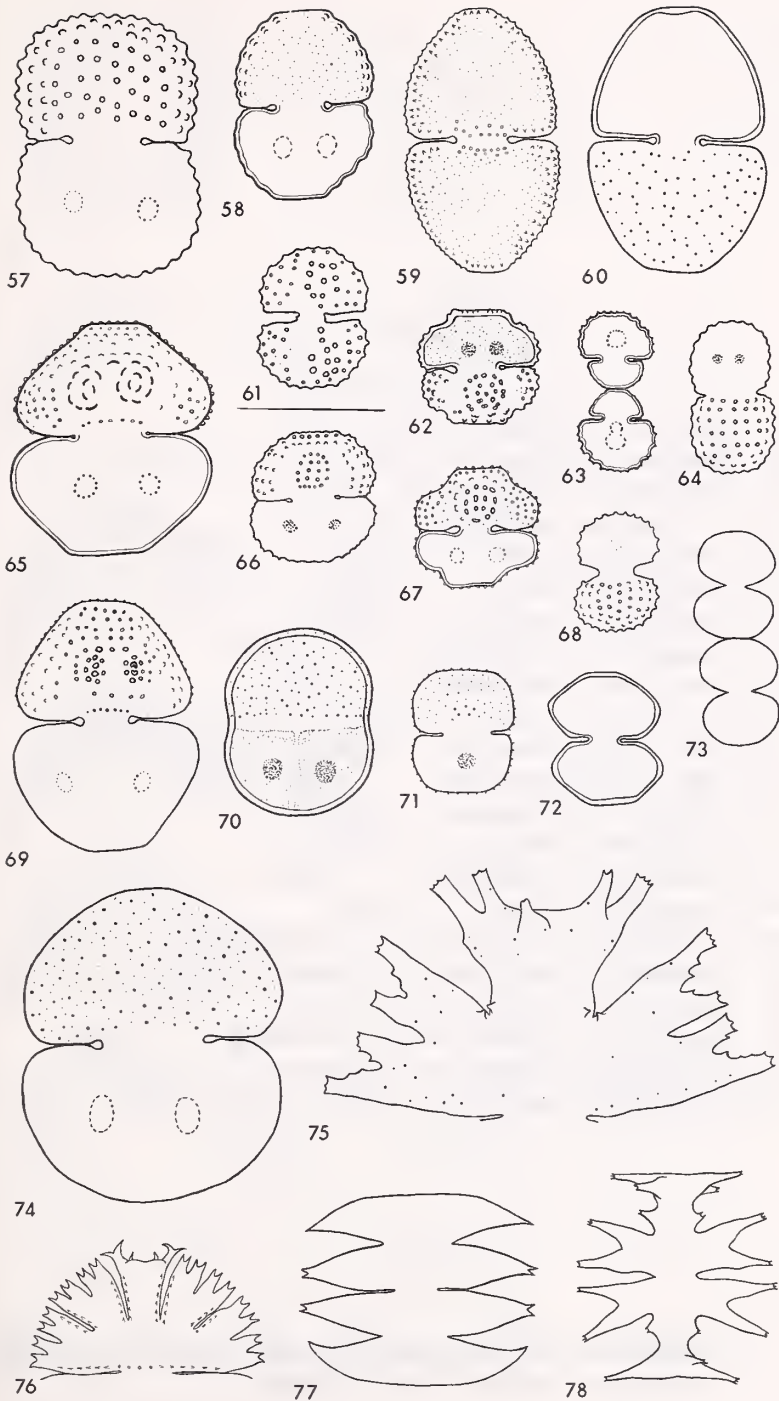
## PLATE III

Figs. 57-78\*

57. *Cosmarium margaritatum* . . . 68x58.
58. *Cosmarium obtusatum* . . . 49x38.
59. *Cosmarium denticulatum* forma *Borgei* . . . 175x102.
60. *Cosmarium pyramidatum* . . . 75x47.
61. *Cosmarium punctulatum* var. *subpunctulatum* . . . 36x29.
62. *Cosmarium ornatum* . . . 30x32.
63. *Cosmarium subcostatum* var. *minor* . . . 25x21.
64. *Cosmarium amoenum* . . . 40x21.
65. *Cosmarium Turpinii* . . . 59x52.
66. *Cosmarium subcostatum* . . . 35x31.
67. *Cosmarium protractum* . . . 33x33.
68. *Cosmarium Portianum* . . . 31x24.
69. *Cosmarium Turpinii* . . . 61x50.
70. *Cosmarium pseudoconnatum* . . . 54x42.
71. *Cosmarium punctulatum* . . . 34x28.
72. *Cosmarium refringens* . . . 35x29.
73. *Cosmarium contractum* var. *ellipsoideum* . . . 30x21.
74. *Cosmarium pachydermum* var. *aethiopicum* . . . 89x72.
75. *Micrasterias americana* . . . 129x70.
76. *Micrasterias apiculata* var. *fimbriata* forma *spinosa* . . . 206x200.
77. *Micrasterias laticeps* . . . 125x150.
78. *Micrasterias Nordstedtiana* . . . 136x126.

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\*Numbers after each taxon indicate the actual overall length and width measurements in microns of the cell figured.



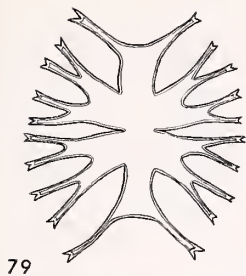
## PLATE IV

Figs. 79-100\*

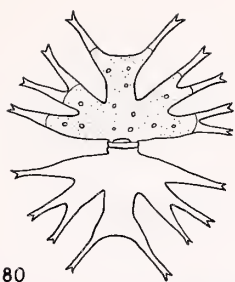
79. *Micrasterias radiata* . . . 166x155.
80. *Micrasterias radiata* var. *simplex* . . . 172x155.
81. *Micrasterias pinnatifida* . . . 70x75.
82. *Micrasterias truncata* var. *semiradiata* . . . 78x82.
83. *Staurastrum grande* var. *parvum* . . . 60x53.
84. *Staurastrum muticum* . . . 26x23.
85. *Micrasterias radiosa* . . . 164x160.
86. *Staurastrum pachyrhynchum* . . . 29x28.
87. *Staurastrum cuspidatum* . . . 21x28.
88. *Staurastrum Dickiei* var. *rhomboideum* . . . 33x64.
89. *Micrasterias radiosa* var. *ornata* . . . 160x155.
90. *Staurastrum punctulatum* . . . 32x32.
91. *Staurastrum apiculatum* . . . 25x18.
92. *Micrasterias rotata* . . . 350x255.
93. *Xanthidium subhastiferum* . . . 50x80.
94. *Staurastrum Dickiei* . . . 45x46.
95. *Xanthidium antilopaeum* var. *minneapolisense* . . . 80x81.
96. *Xanthidium antilopaeum* var. *callosum* . . . 82x81.
97. *Staurastrum Dickiei* var. *circulare* . . . 39x35.
98. *Xanthidium antilopaeum* var. *polymazum* . . . 86x84.
99. *Xanthidium cristatum* var. *uncinatum* . . . 75x61.
100. *Staurastrum tetracerum* . . . (apical and face view) . . . 23x23.

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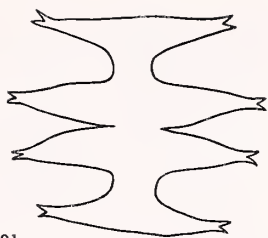
\*Numbers after each taxon indicate the actual overall length and width measurements in microns of the cell figured.



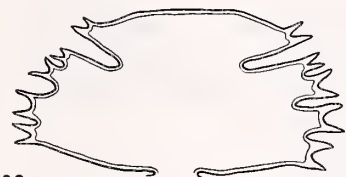
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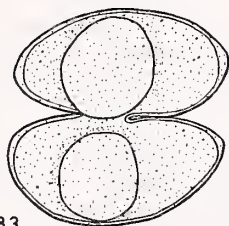
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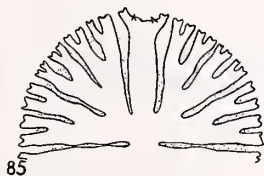
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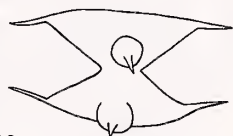
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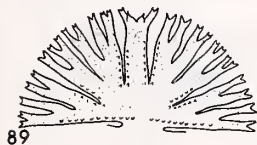
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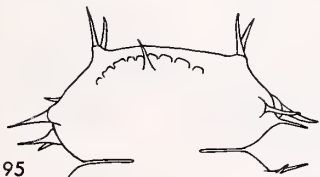
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## PLATE V

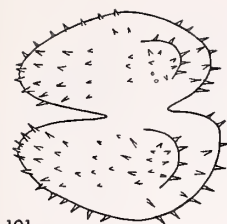
Figs. 101-128\*

101. *Staurastrum Brebissonii* var. *brevispinum* . . . 48x45.
102. *Staurastrum Ophiura* . . (apical view) . . . 80x145.
103. *Staurastrum crenulatum* . . (apical and face view) . . .  
27x32.
104. *Staurastrum dilatatum* . . . 23x22.
105. *Staurastrum setigerum* . . . 45x47.
106. *Staurastrum polymorphum* . . . 25x32.
107. *Staurastrum pseudopelagicum* . . . 35x44.
108. *Staurastrum pseudopelagicum* var. *minor* . . . 35x44.
109. *Staurastrum rugosum* . . . 35x45.
110. *Staurastrum longiradiatum* . . . 85x63.
111. *Staurastrum brasiliense* var. *Lundellii* . . (apical and face  
view) . . . 126x120.
112. *Staurastrum furcigerum* forma *eustephana* . . . 51x49.
113. *Staurastrum tetacerum* var. *evolutum* . . . 58x50.
114. *Staurastrum furcigerum* . . . 65x50.
115. *Staurastrum cuspidatum* var. *canadense* . . . 30x22.
116. *Staurastrum Johnsonii* . . . 42x84.
117. *Staurastrum Arctiscon* var. *glabrum* . . . 130x120.
118. *Onychonema laeve* var. *latum* . . . 20x26.
119. *Desmidium Baileyii* . . . 20x24.
120. *Staurastrum Arctiscon* . . . 120x122.
121. *Gymnozyga moniliformis* . . . 25x17.
122. *Desmidium Swartzii* . . . 15x38.
123. *Hyalotheca dissiliens* . . . 14x18.
124. *Spondylosium planum* . . . 13x12.
125. *Sphaeroszma excavatum* var. *subquadratum* . . . 9x5.
126. *Hyalotheca undulata* . . . 13x7.
127. *Sphaeroszma granulatum* . . . 9x10.
128. *Desmidium Grevillei* . . . 21x43.

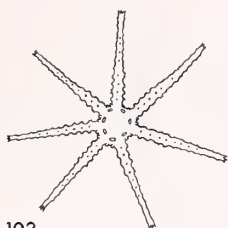
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\*Numbers after each taxon indicate the actual overall length and width measurements in microns of the cell figured.





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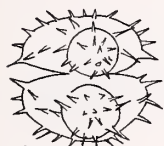
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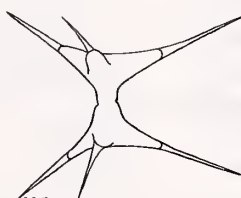
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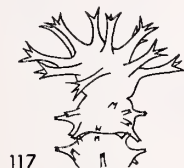
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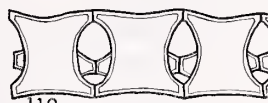
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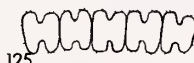
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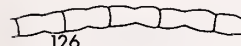
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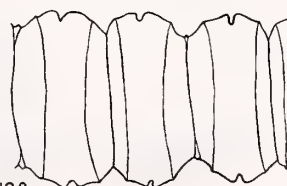
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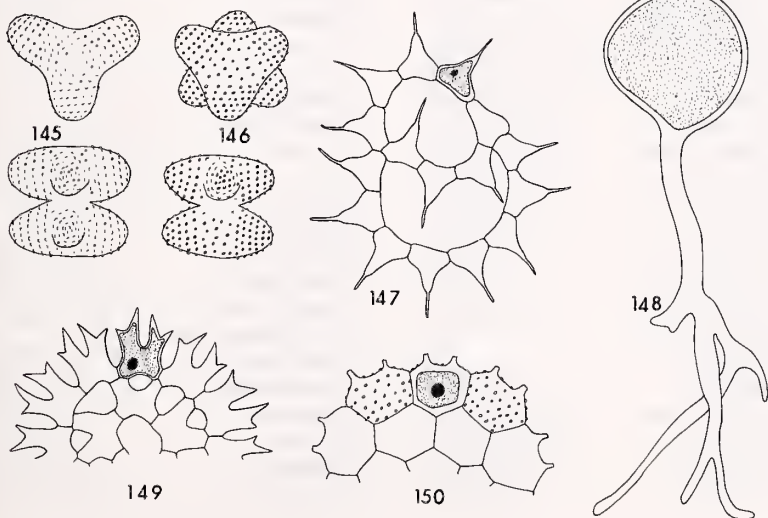
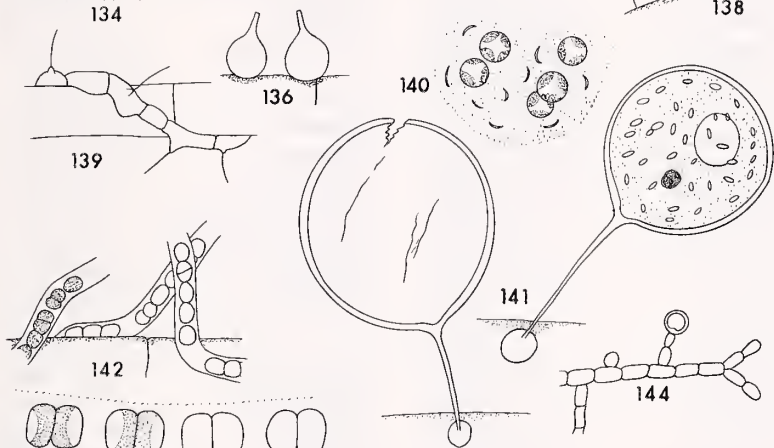
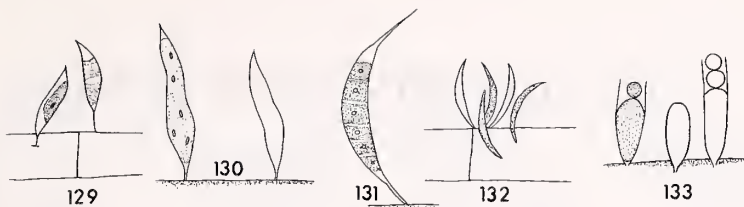
## PLATE VI

Figs. 129-150\*

129. *Characium ambiguum* . . . 28x6.
130. *Characium ensiforme* . . . 50-60x6-12.
131. *Characium limneticum* . . . 70x9.
132. *Ankistrodesmus falcatus* var. *stipitatus* . . . 19x3.
133. *Entophysalis lemaniae* . . . 15x5.
134. *Chaetosphaeridium Pringsheimii* . . . 23x11.
135. *Lagynion macrotrachelum* . . . 17x11.
136. *Lagynion ampullaceum* . . . 19x12.
137. *Stylosphaeridium stipitatum* . . . 17x7.
138. *Stipitococcus apiculatus* . . . 16x4.
139. *Aphanochaete repens* . . . 15-30x8-10.
140. *Schizochlamys gelatinosa* . . . 12-15x12-15.
141. *Stylodinium globosum* . . . 70-80x35-40.  
(empty cell and vegetative cell)
142. *Lyngbya Nordgaardii* . . . 1-3x1.5-2.
143. *Radiofilum flavescens* . . . 15x10.
144. *Nostochopsis lobatus* . . . 6-12x3-5.
145. *Staurastrum illusum* var. *majus* . . . 33x35.  
(apical and face view)
146. *Staurastrum alternans* . . . 32x30.  
(apical and face view)
147. *Pediastrum simplex* var. *duodenarium* . . . 11-13x26-28.
148. *Botrydium granulatum* . . . up to 3mm. in diam.
149. *Pediastrum biradiatum* var. *heteracanthum* . . . 13-15x7-9.
150. *Pediastrum integrum* . . . 15-18x18-24.

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\*Numbers after each taxon indicate the actual overall length and width measurements in microns of the cell figured.



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